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A STUDY OF DREAMS.

BY JULIUS NELSON.

Every psychological inquiry should as far as possible be based upon and connected with so much of physiological knowledge as we can command. It is not our desire to do this in the present article in any thorough manner, but for the purposes of introduction and orientation a few primary principles may be premised.

Look at the subject from whatever point of view we may, we cannot escape the fundamental conclusion that the human body, in its entirety, is a *cell-state or colony.* The individual acquires his character as a *unit* from the extreme differentiation and consequent division of labor obtaining among the cell units. There can therefore, in reality, be no *new* physiological or psychological function or faculty or characteristic in the soma which was not and is not in the cells. If the complex body seems to differ markedly in its powers from the simple cell, it is because the work

necessary to sustain the life of a cell has been distributed among many units, and thus many diverse combinations and interrelations of the cell functions become possible. Nutrition and growth (and reproduction), respiration and movement, irritability or response to stimuli, heredity and variability, and probably spontaneity or will, are the fundamental properties of protoplasm in its simplest state. All other powers of living things are secondarily derived by evolution (*i. e.* differentiation) of these primary properties, due to the *educating* forces of the environment acting through time. All these questions in biology and psychology, then, ultimately rest on cell physiology. We know very little about cell physiology, but we do know a few facts the knowledge of which will prevent us from making rash statements about the relations of brain cells to mental processes, such as are frequently made and which carry the air of final explanations. Such statements are, that images, stimuli, ideas, are impressed on the cell protoplasm just as if it were a photographic plate, and that consciousness simply "reads" these impressions. Memory is the strength with which protoplasm retains the impressions. When we learn a new thing it is stored up in a new cell, or a new connection between old cells is made. Finally it is asserted that nerve force (or at least stimuli), once flowing along a certain line or direction, maps out a "path," along which it becomes easier for it to flow next time, and so we form habits. The nerve fibres are supposed to represent the morphological result of such flows of force.

All this is crude fancy and finds no support in modern cytology. All the changes that take place in cells are undoubtedly chemical and physical. But the

actions of cell life are not explained even were we able to write the whole equation of the correlation and transformation of the forces present. We would still have to account for the *reason* of the change, for the organization of these forces, and, in fact, for that which makes the phenomena *vital* as distinguished from non-living chemical transformations. We know that complex chemical compounds are built up in cells with attendant absorption of oxygen. This requires energy, and that is furnished by the breaking down of the highly complex substances furnished by the food in the lymph and blood. Then when the cell works there is a liberation of energy due to the breaking down of these highly complex molecules, and waste products are thrown into the blood. The latest researches seem to show that, if not all the energy of a working cell, at least a great deal more than was formerly supposed, is furnished by the breaking down, not of the food directly, but of the living substances of the cell, which have themselves been built up out of the food. This is shown by the remarkable chemical and morphological changes which the *chromatin* of the nucleus undergoes when cells are active.

It is the chromatin, as we have shown elsewhere,[1] and as is now widely believed among cytologists, that is, as it were, the *brain* or *soul* of the cell. In it inheres the psychic or hereditary powers; and if it be removed from a cell, the rest of the protoplasm behaves automatically. The cell then moves mechanically, cannot reconstruct itself, and finally wears itself out and decomposes.[2] The difference between the chromatin

[1] "The Significance of Sex." *American Naturalist*, January, February and March, 1887.

[2] See Gruber, "Beiträge zur Kenntniss der Physiologie und Biologie der Protozoen." *Bericht Naturforschenden Ges. Freiburg*, Vol. I, 1886.

and chemical substances that are devoid of chromatin is this. In the latter case any drug or stimulus produces an effect in accordance with fixed laws, but the chromatin has the power of interpreting stimuli, and its reactions are intelligently directed towards the preservation of its own life, and thus of the cells, and hence of the body. When a poison is absorbed by a cell, such poison forms chemical compounds with the protoplasm (therefore it is a poison), but the chromatin does not allow itself passively to be destroyed, but at once manufactures more chromatin as fast as it can, and thus supplies more than sufficient to satisfy the poison, and then the cell proceeds to excrete the saturated compounds.[1] In this way the chromatin can be *educated* to endure a great quantity of poison.[2]

The morphological structure of cells is such as the conditions of nature have shown necessary and advantageous for allowing the chromatin to live and grow, to differentiate, to receive stimuli, and to react upon the external world. Hence we have the chromatin in one or many spherical bodies in a nucleus, and the whole encompased by cell plasma that serves it for a house and for organs of relation. The structure of cells, therefore, is such as enables them best to do their work, such as absorbing food and moving by pseudopodia or cilia. There is not the slightest hint of structure with relation to anything else. They who think the complex structure of higher animals is in some way mirrored in their cells, or in the cytological structure

[1] See Stolnikow, "Vorgänge in den Leberzellen, insbesondere bei der Phosphorvergiftung." *Du Bois Archiv*, 1887, *Phys. Abth.* Supplement.

[2] Should later studies show that this reaction is not so simple a one as Stolnikow assumes in interpreting his sections, the general fact of the educability of protoplasm still remains.

of the eggs from which the cells are the descendants, do greatly err and have not conceived the problem of heredity from the vital and psychic standpoints. Cytologically at least, the ovum of a complex animal is as simple, even simpler than many of the single celled animals. In the same way must we think of the brain cells as in no great respect different from other cells. All cells are endowed with the fundamental properties of living matter, and when differentiation comes in, it is simply a distribution of these properties. A nerve cell is one differentiated especially to receive and react to stimuli in such relations or connections as to correlate organs. A muscle cell is one so constructed as to react by manifesting as great an amount of motion as possible. When a nerve cell acts there must be a breaking down of chromatin, just as when a liver cell acts. Who can prove that a splitting up of chromatin in the one case differs from that in the other, and who can imagine how such difference can account for consciousness or any psychic characteristic of ideas and sensations? Can we conceive that food which a little while ago was solvent in the lymph, and now has been built up into a complex molecule of chromatin, can remember, when a vibration reaches it and causes it to break up, that the chromatin which was its predecessor was broken up by a stimulus of like kind, (even supposing that the nerves are differentiated so as to transmit different sorts of vibrations or stimuli for the different sorts of external excitants, which is indeed an open question)? We see, then, that if anybody wishes to believe in *spirit* apart from matter, that this spirit can be *organized* and be an immaterial governor of material forces with which it can be in mysterious connection, and that the properties of spirit

and of matter are in no way similar, but totally dissimilar, such belief is in no way shaken by the very most recent advances of biological science.

We have seen that when a cell acts in any manner there is a degradation of chromatin. If this activity breaks down the chromatin faster than it can be built up, the cell must stop and rest. This resting, when it takes place in the higher psychic centres, presents the phenomenon of sleep. Only a few cells of the body sleep, and, as many parts of the brain are nowise tired out, they may still act during sleep. If these are the cells involved in psychic processes of some sort or other, we get dreams. In order that the tired brain cells may be allowed to rest undisturbed, the vital functions of the body are lowered to a minimal intensity. The easiest position is assumed, secluded from stimulation from the external world, because many of the cells are in good and increasingly good condition to react on stimuli, so that if these are not shut out, the restoration would be interfered with. Here, *habit* controls the action; for when the cells receive stimuli that have no significance for the welfare of the body, they do not *react*. The cells have to be educated to this attitude, for when unusual stimuli, as from a strange sleeping place, strike the senses, our sleep is more or less disturbed.

The blood does not flow so much to the brain during sleep, yet it is not altogether shut out, because food and oxygen are needed to restore the tired cells. This fact has much significance, for we know that when an organ acts it receives an extra amount of blood, and that in a general way the character of our mental activities is controlled by the amount of blood in the acting cerebral ganglia. It is therefore quite possible

that some ganglionic cells act in a feeble way all night, but, because of the feebleness of the action, we never recollect anything about it. But there may be disturbing causes, such as irregularity in the relations of controlling centres, or stimuli from diseased or uncomfortable organs, that tend to set certain ganglia into activity and call an increased flow of blood to the part, and thus vivid dreams will arise. As morning approaches, and the cells have gotten well rested and are quite irritable, they are ready to "explode" their chromatin at slight offence, and at last there is a general awakening, which is accompanied by a return of blood to the brain. There cannot help but be a "dawn" in consciousness just before getting awake and becoming aware of the external world, and thus people generally wake up out of a dream state. Of course the character of dreams will depend on several factors, such as the extent of the brain involved, the amount of irritability, and in a general way to the sort of stimulus, and of course on the interests, education and experiences of the individual in the immediate past.

There is undoubtedly one common psycho-biological law explaining the activities of the brain cells; how they act on a common stimulus producing a sensation; what is involved in perception, in an apperception; what in recollection; what in memory; what in reasoning; what in volition; what in desiring, and in emotions. How are the cells related; what cell activities are primary and what are secondary; which cells are exciting and which inhibitory? These are questions that must be answered before normal psychic action can be comprehended. Then we shall be in a fair way to readily comprehend how we get all degrees of disturbance of these normal relations leading down to the

deepest insanity. We shall then see why there is such a marked similarity among the different sorts of abnormal manifestations, such as the hallucinations of insanity, the delusions of hypnotism, the experiences of the dreamer, the fancies of revery, and still other facts in anthropology.

Although the ultimate solution of these problems depends on advances in the science of cell physiology, we need also to know all that other methods of study will yield. We must know gross anatomy before histology. I took up the study of dreams as a convenient portal to the general subject of hallucinations, and with the hope of adding to our knowlege of this most fascinating field of psychology. In the month of November, 1884, I began recording my dreams, and have accumulated the records of over one thousand dreams per year since that date. Two thirds of these are more or less elaborately detailed, so that we have here a great quantity of matter which will require much time to properly and thoroughly study. The present article is only a preliminary report due to a general survey of the data, and serving to introduce more detailed studies to follow later. It is to be hoped it may also stimulate others to study their own dreams at least; for only by comparison are we able to generalize and to discover what is idiosyncratic in these manifestations.

In many cases it helps a student to become thoroughly familiar with the work and theories of others in the special line he proposes to follow, to serve as a guide and to prevent the waste of misdirected efforts. In this study, however, it is best to read sparingly until considerable headway has been made in one's own method; the reason being that much of the literature in this

line is more of a poetical than of a scientific nature, and that a tendency to view one's own states with a special bias is readily and unavoidably given. There is a tendency to be interested in the *matter* of the dreams, in its æsthetic effects, much as we react towards ideas and events of real life in relation to our well-being. Of course this is the unscientific standpoint. The fact that a person dreams much or little is of more significance than *what* one dreams. A curve representing the variations from day to day in the amount of dreaming has scientific interest, while the hobgoblins that we saw are of interest to children.

The introspective method has two stages. At first we simply observe the phenomena presented by nature in their serial and concurrent relations, and from the light thus afforded we are enabled to experiment or to control certain conditions with advantage and intelligence. So far I have confined myself to the first of these methods.

There are a few pertinent biographical details that should accompany each student's memoir. I may be said to possess the dreamy diathesis in a strong degree, manifested from early childhood to the present time, a period of 30 years. My mental make-up is inherited mostly from the paternal side and is erethic in quality. The nutritive functions have been derived from the maternal side and present an irritable digestive system. My father rarely dreams, but my mother has many dreams in which she takes great interest. My memory is strong only in its visualizing power.

As a child I was subject to cramps, costiveness, and nightmares. The interrelation of these facts is evident. In regard to health, I have improved steadily with age.

Dreams that occurred before my fifth year of life are quite as vivid in my memory as the few waking

scenes of that period which I can recall. In the period lying between my eighth and twelfth years my dreams were peculiarly troubled; but at present my recollection of them is vague. On retiring I reviewed the events of the day over and over again, introducing variations and often new chapters with the slightest effort, yet had I undertaken to write a novel I should have failed. Often before my eyes there appeared mosaics of colors, expanding and contracting or rotating; and this especially if my eyes were shut. At times I could see malign faces appear on the walls with great reality and distinctness. If no nightmare caused me to awake during the night, the dream, however pleasant, always took a disagreeable and frightening turn on waking in the morning. I felt myself lifted up as if gravity had temporarily reversed its action, and then I was dropped from a great height back to earth, which I neared in increasing fear and loss of breath. But I always awoke just before striking the ground and when the fear seemed to be at a climax. Some mornings a pleasant dream would be substituted, and when the pleasures of anticipation of some rare treat were at a climax, just as the treat was about to be enjoyed, I awoke.

My mother taught me a remedy for bad dreams which I applied with immediate and universal success, viz., on composing myself for sleep, the object of a dreaded dream was by voluntary act brought before my mind, and while held there I said mentally, "Shall I dream of that?" (here visualizing the scene which past dreams had taught me to fear), and then the subject was dismissed with a confidence that I should not be troubled by that dream for that night. Should the feared scene again intrude into consciousness

before sleep came, it must once more be dismissed by the formula or my work were vain. Thus one by one I rehearsed the list of bugbears every night, making special effort not to treat pleasant subjects in like way, for then I knew they would not be dreamed about. By this means the mind passes from a state of fear, where the image haunts it, to one of confidence and control, where by some automatic action, similar to that by virtue of which we can wake up at a set time, the mind retains control throughout sleep.

I am subject to three distinct classes of dreams, which for convenience may be designated respectively (1) evening dreams, (2) night dreams, (3) morning dreams, as showing the time of the sleeping period when they most generally take place. Perhaps a fourth class could be added, .viz., those excited by digestive derangements, such as nightmares ; but they are rather modifications of the others, due to extra exciting causes at work for a definite period during any portion of the night. The first two classes are rare dreams ; the third class makes up the main bulk of the dream record.

Class I. This takes place only when I can manage to get to bed when very tired and very sleepy, without getting thoroughly awake in the effort to doff my clothes. I am then in a semi-somnambulistic condition, while still conscious of my surroundings. While in this state I suddenly experience a nervous discharge which throws many of my muscles, sometimes including those of voice, into violent activity, as in a single twitch, so brief is the action. I have the sensation of passing out of a comatose state into the ordinary state, which is followed by tranquil sleep. Never has sleep proper followed such a state without this sudden dis-

charge and feeling of psychic change. Dreams often accompany this state whose tragic climax coincides with the discharge. Psychically the discharge is felt as the effort of the body to escape the impending danger, not through voluntary but through reflex action. Once, after severe exercise of skating, I retired with the sensations of the movements and scenes of the day reverberating through my nerves. While still conscious of my room, I lay reviewing the scenes of the day as they whirled by with unwonted vividness, until suddenly they became real, I was dreaming, a hole in the ice developed, into which I fell with a shriek and a struggle that was real and no dream, much to the amusement of my bedfellow. Had this been an ordinary dream I could have experienced the same series of psychic phenomena without the muscular movement. These dreams occurring immediately after retiring have no real sleep connected with them, while ordinary dreams accompany waking from sleep of longer or shorter duration. A strange sense of reality may sometimes be present when the scene of the dream is laid in my bedroom and I am conscious of being in bed; then on waking there is nothing to prove that it was a dream except the peculiar circumstance which the dream introduced. Thus one evening after composing myself for sleep I saw a white figure approach my couch. Full of dread, I threw up my arm to ward off the spectre, and awakening, it immediately vanished. On learning that no one had entered the room, the sudden and unreal way in which it vanished, and reflecting that had I been awake I should not have been frightened, and not being a believer in ghosts, I concluded it must be a dream. Thus a process of ratiocination was required to properly characterize the phenomenon.

Class II. This class results from excessive stimulation of psychic or sensory organs, by which, to use a material figure, the molecules of the nervous substance are so set in vibration that they continue to vibrate during a large part of sleep. Such reverberations are felt during the waking period as well. The boy who has spent a glorious Fourth of July retires with the booming of guns and the blaze of fireworks before his mind, and these images haunt his dreams in grotesque forms. The student, after hard work at his algebra, has similar experiences with x's, y's and z's. Sleep is disturbed; the brain is too full of blood to allow perfect sleep, and real rest comes not for hours. Perhaps the mind works, even in a logical manner, to solve vexed questions, though this must be seldom.

The dreams of Class III, as we shall see, are very different things; but before taking up this class, a few words about the dreams which we may designate as Class IV. Violent palpitations of the heart and intense peristaltic writhings of the intestines accompany such dreams in my case. Here I do not suppose the dream is to be considered secondary to the physical phenomena, but rather that by nervous or psychic sympathy the physical organ is reacted upon by dreams which it originally excited and determined the character of.

Class III, morning dreams. These occur when the brain has had a period of rest and repair; perhaps we may speak of it as a period of bloodlessness, and now, on waking, blood is rushing in, with a rapid rise of blood pressure in the brain. They differ also from other dreams in the faintness of their images, by virtue of which they are almost immediately erased from consciousness by external stimuli received on awaking. They

differ also from the foregoing classes in the fact that they are new or varied combinations of past mental experiences, worked up with great fertility of fancy and multiplicity of transformation. Events of the day before, preferably scenes of two days ago (as if those of yesterday were not faint enough) which have been forgotten, so trivial were they, are set in a background of scenes of my boyhood. The most trivial act of attention to an object one passes on the street, which would never again be thought of, is often the "hero" of a dream scene. No new sensations are introduced into these dreams; but just as soon as a new sensation is experienced in waking life, is it seized upon as material for these creations, which are after all only grotesque combinations, although exceedingly real in that they possess the detail and completeness of natural scenes. One may dream of riding on the cars who has never ridden on them, but his sensations will be simply those he imagined while awake, when thinking of the subject. Not until a person has ridden on the cars can he experience in dream the true sensation thereto belonging. This law holds in my case with every possible experience of life.

On the transformation of dream scenes.—In waking life one may see a person in the distance approaching who may be judged in all confidence to be Mr. A. On his nearer approach he is seen to be Mr. B. In this mental process there is no surprise, neither is there in dreams where a person judged to be A is shortly seen as B. The same is true of objects; and in this case of transformation, one or more of the objects in a dream scene may change without a corresponding change of the others, called for in nature. In this way places and things and persons never associated in our waking

experience are brought into juxtaposition, thus making it difficult to properly relate the parts of a dream to one another on waking.

A second method of transformation is by what I designate as *realized fancy*. In waking life, in viewing a scene or event I fancy certain modifications or expect certain things that do not occur, and properly should not occur except that the exuberance of fancy drags them in. In dreams I have similar fancies, but here I find them realized. If I picture to my imagination that I am at a certain distant place it does not take long before I am actually experiencing *passively* what a moment ago I was *actively* presenting to my mind. This is a fertile source of transformation in dreams. These transformations it is, that make it so difficult to remember dreams and to properly relate them; for at times it seems as if an event might have two antecedents in a dream, as if one had a double consciousness for a short time, and had been enacting a rôle on two different fields at once, which in some unaccountable way became one field and one person. Perhaps it is only a difficulty of the rational mind in trying to remember what took place in a mind in which reason was dormant.

We are now prepared to discuss *methods* of record and of study of the record in connection with the results obtained by their application. One must accustom himself to holding the attention fixed upon the scenes of the dream world after waking in the morning and not allow the attention to be diverted for an instant to the scenes of the external world, or the superior strength of its impressions will instantly blot out the faint images of the dream. Then, by carefully reviewing the events of the dream it may be

more indelibly fixed on the memory. It is well, however, to have pencil and paper at hand and jot down the dream, at least skeletonwise, to aid in reconstructing it when the record is more carefully made. A single word in this way is sufficient to recall the dream by. Objects we meet in our daily walks, by a similar process, set us to feeling that some experience has passed in our life in connection with them somehow, and when the experience is unravelled it is found to be the fragment of a dream, which dream was either suggested by the object itself when it was scarcely noticed a day or two before, or if it had made a strong impression, that impression was made long ago, or else the object is similar in some way to the dream object so as to suggest it. One has to have his note-book with him all the time, for he knows not when an object may help him recall a dream. I find that the completeness with which a dream can be recalled, roughly speaking, depends inversely on the time which has elapsed between its occurrence and its first recollection. But a similar law governs all subsequent recollections. Thus if a dream be carefully rehearsed to fix it on the mind before rising, and a word or skeleton "suggestive" be made, should a portion of the day's activities intervene before the dream is recorded, the "suggestive" will aid in restoring much less of the details than if the scenes are fresher. The dream itself has all the completeness of nature, and if immediately observed by the active attention can be studied as a landscape is, except in the case of dreams one is allowed only a momentary peep at the scenery and then has to restore as much as he can recall. The dream records I have made are therefore very meagre compared with

the real dreams. The relation is exactly similar to that existing between a landscape itself and the description of a landscape by a passing tourist. But I find the impression of a natural scene, however short, is stronger than that made by these exceedingly faint images.

When I first began recording, the mind seemed so full of the subject that I would wake up during the night just to dream and to record dreams. So I had to put a sliding frame with a slit in it over my tablet to guide the pencil while writing, or else the lines would be superimposed in an undecipherable manner.[1] But this extreme zeal caused nervous prostration. It is a really exhausting process to keep the attention held on faint impressions in the presence of strong ones, and the effort to recall the faint details is also exhausting, so that I was compelled to adopt a more careless attitude of mind towards the record; but I think the laws we shall subsequently reveal have not been thereby affected.

When the attention is turned to a dream scene passing in the mind, on awakening it can recall certain antecedent events that join onto the ones present, and so on back into the night; though of course we must not let the time relations presented by the dream be any guide here, for one can dream of a year in a minute, or take part in events lasting hours in a moment. The dream stretches back and grows fainter and fainter until no more can be recalled. This seems to harmonize with the view that our morning dreams take place only during the passage from sleep to wake-

[1] Such writing, made by the sense of touch and motion, is crowded laterally as one feels that he passes over more space than in reality.

fulness, or while the blood pressure in the brain rises from a lower to a higher level.

Now, when the mind travels backward over a dream in the way last indicated, beginning with the dream scene present when just awakening, it goes backwards by jumps; that is, the dream has a moniliform or segmented character. It is a chain composed of links of more vivid scenes connected by scenes less vivid. The links only are recalled in the inverse order; the events inside each link are seen in their true progressive relations. When from any reason the scenes are less vivid, as from having allowed the outside world to intrude upon the attention, the fainter parts drop out, and these parts usually correspond to those details by which some principal object, person, or event of one link becomes by transformation the nodal or focal point of the succeeding link. In such a case the two links seem distinct and are recalled as distinct dreams, though the mind has a vague sense that they are only fragments of longer dreams without at the same time connecting them. Several links may be bound together into larger links. This appears to be due to the mental relations of the events themselves; but it has occurred to me that there might be a physiological explanation of this moniliform character in that the blood pressure varies with the pulse and respiratory movements, and as the waking period occupies a few of the larger and many more of the shorter waves, we here have something quite corresponding.[1] If the dreams are vivid, or if memory is good, then we have one long dream composed of many transformations. If the dream is less vivid we get a few fairly

[1] See Mosso, "Über den Kreislauf des Blutes im menschlichen Gehirn," Leipzig, 1881.

long dreams, although some of these may be short and consist of but one node. Then if the dream has been very faint we get only a few scattered nodes of events, persons or places about which we dreamed, but we cannot recall details. We can also secure all these conditions by recording successive days in bed, or after rising, or after breakfast, or after dinner, or after supper, and if we wait until bedtime we can be glad if we are able to recall a single particle of dream. But suppose we make a practice of recording the dream, say just on awakening, then we shall find that some mornings we have the greatest degree of vividness and unity, and on others the least degree, and with all intermediate stages represented by different mornings. *It therefore follows that the number of dreams a person can recall has no direct significance, but only the total amount dreamed.* Guided by this law I proceeded to count the total number of words in the dream record of each day and to plot the curve for the whole time, and the results obtained we now proceed to discuss.

Some dreams are so vague that nothing of detail can be made out, but only that I dreamed about such or such thing, or that I recall a single object out of a dream scene. This object I have designated the node or focal point of greatest vividness. This node is the last to fade out, and if the dream scene was vivid enough it is by means of this node that the memory restores the accessory details. I divided the dreams into two classes, viz. those consisting of a single bare nucleus and those more complexly organized. In a table at the close of this paper I have grouped the daily records according to length from 1 to 900, which was the longest record for one day. Opposite each group I have placed the number of days that presented

records of that length, and in a third and fourth columns the corresponding number of dreams, complex and simple; in two additional columns the average daily number of dreams; and finally, the average length of the dreams. A little inspection shows us that the simple dreams tend to remain stationary, or to decrease in number as the record lengthens. The complex dreams, while increasing in number, do so at a rate of increment 100 times smaller, while the average length of dreams increases five times as rapidly as their number. As the unit of measurement is diverse in these cases, this relation simply means that the average length of all dreams is 100 words. These facts are in perfect accordance with the theory. It is total amount and not the number of dreams dreamed that measures the physiological action.

We have already seen how easily the length of the record for any day may be affected if the attention is called off, if one oversleeps so as to be hurried, and various other things occur to curtail the record. The two chief causes of disturbance are pressure of work and unusual experiences or occupation, excitement, etc., like a journey, for instance. I was able to pick out of my record thirty consecutive months which were fairly uniform in my experience, the great disturbing sources not having acted many days at a time during this period.[1] The first two weeks of my record show a steady rise in the curve, which is in accordance with the law that attending to one's dreams increases their number, *i. e.* increases the number we become aware of having. But this law ceased to operate after the climax was reached. The curve was seen to be very irregular,

[1] I later discuss a disturbing action which was present regularly during each May and June.

with a mixture of short and long records without apparent law; still one could discern a crowding together of the long records at certain points. A parallel curve of the moon's phases showed that the two curves were independent. I then chose the physiological or sexual month of 28 days and found there the period I sought. I thought that 30 months when summated would be sufficient to equate the petty disturbing influences, and thus I could get a curve approximately showing the actual state of affairs.

The table at the close of this paper shows the numbers from which the curve has been constructed. The nature of this curve and the fact that it was plotted for a menstrual period requires that we compare it with a curve representing the sexual condition. In the human female we have presented the monthly phenomenon of the katamenia lasting nearly a week. This phenomenon has relation to the functions of reproduction. Although the phenomenon is still not thoroughly understood, we have data[1] which show that during this period one or more Graafian follicles burst and set free ripe ova which are passed down the Fallopian tubes, and if fertilized, remain to be developed in the uterus. The cause of the bursting of the follicle is due to a congested condition of the ovaries, or a heightened blood pressure in them and accessory structures which may account for the uterine hemorrhage, but coitus may probably accomplish the same effect and thus prevent an impending menstrual flow. At any rate, after the flow has ceased an ovum is present in the tubes or uterus most favorably placed as regards fertilizability, and it is well known that the female is

[1] See Geo. Arnold, "Zeitliche Verhältniss der Ovulation zur menstruellen Blutung." Würzburg, Dissertat. 1887.

most erotic and irritable at this time. The physical cycle is accompanied by marked psychical characteristics that gradually increase up to the period, and after a temporary decadence during the flow, present a sharp climax a week later. We shall term the first climax the *minor climax* and the second the *major climax*.

It is readily seen why the erotic state should be at its climax when the ovum is ready for fertilization. We have no direct means of measuring this condition as a curve, but we can do so indirectly. The first curve of the plate marked *A* is taken from Hermann's Handbuch der Physiologie, Bd. VI, part II, p. 74, and represents the frequency of conception with time-relation to the menstrual period. The two climaxes above noted are well shown, though the curve was plotted only with reference to a preceding menstrual period and not with reference to a subsequent one.[1] As the periods of women differ in length, the minor climax does not come out in its true sharpness and height. Undoubtedly there are other ways probably superior to this one of measuring this physiological period indirectly, but I am not aware that any available data have been gathered with reference to this point.

It would only seem natural that the male should also show a sexual period corresponding to that in the female, and that in well matched couples the climaxes would coincide. Concerning this point we read in Foster's Physiology (page 691, fourth English edition, 1883): "Within the year an approximately monthly period is manifested in the female by menstruation,

[1] The dotted curve was plotted with reference to the close of the period, the other with reference to its beginning.

though there is no exact evidence of even a latent similar cycle in the male." On the other hand, in Dr. Hammond's "Treatise on Insanity," published the same year (page 114), we read, "Gall contended that there was a periodical manifestation in men analogous to that existing in females, ... and Lévy holds a similar opinion. The latter states that 'young and robust persons do not notice this tendency unless their attention is specially directed to it, but men feebly constituted, or endowed with a great degree of irritability, or who have reached the period of their decline, perceive the alteration which their health monthly undergoes. . . . . The feeling of discomfort is general and inexpressible, and the mind participates in it, for it is more difficult to maintain a train of ideas; a tendency to melancholy, or perhaps an unusual degree of irascibility, is joined to the indolence of the intellectual faculties. These modifications persist some days, and disappear of themselves.'

"I have certainly noticed in some of my friends this tendency to some monthly periodical abnormal manifestation . . . . I think this is much more common than is ordinarily supposed, and that careful examination or inquiry will generally, if not invariably, establish the existence of a periodicity of the character referred to."

In my experience, young and robust persons are subject to recurrent periods of wakefulness at night, which, when they coincide with the full moon, are attributed to the action of its light. Undoubtedly the light of the moon has an independent action of this sort; but if Mantegazza's theory is corrrect, that the sexual period became established with relation to the lunar period because moonlight nights were favorable

to courting, there is a strong association existing between the moon's light and the excitation of the psychic-sexual functions. However, the period long ago became so firmly established as to run independently of the phases of the moon, and even to vary from its length so as to have a precessive relation to the moon's phases. The influence of that old institution, the Sabbath, must have had a powerful effect in fixing the period at twenty-eight days; but this period is easily influenced by exciting or nerve depressing causes, the former shortening the interval, and the latter delaying the period, or even preventing it to a great extent.

In the male as in the female, the maturation of the reproductive elements is a continuous process, though we may hardly say that it is not influenced by this mensal periodicity. It certainly is influenced by many incidental forces, such as food, temperature, exercise, occupation, sexual excitement, etc. But here, as in physics, we ought, I think, to consider each force still acting and producing its proper effects though the resultant may fail to reveal the direct action of any one element at a particular time. The mensal period is a steady force, the others are accidental and variable in time; hence if we take a sufficiently long period and summate by months, the disturbing forces will largely equate their effects, whereas the mensal force will thus reveal its true action. The presence of the reproductive elements exerts a constant stimulus upon the brain cells, which causes them to generate characteristic dreams that in turn react to produce expulsion of the gametal cells.[1] This *gonekbole*[2] will be more frequent at periods when the psychic cells are

[1] See Martin, *The Human Body*, Appendix, p. 13.

[2] *σπερμοβολία* is the more correct term, but scarcely as convenient.

most irritable, and therefore furnishes data for plotting the sexual curve in the case of the male, and the result is shown in curve *B* of the plate. As in the previous curve, it is only an *indirect* measure of the physiological rhythm we are considering. Here also we get two prominent cusps in the curve, in the form of a minor and a major climax, one week apart, and thus exactly corresponding to the climaxes in the case of the curve *A* of the female. The figures on which this curve is based are given in the table.

A similar treatment of the dream values gives us curve *C*. Here the two climaxes appear again in their corresponding positions, but approximately equal in value. In the sexual curve the climaxes fall on Tuesdays, while in the dream curve they occur on Wednesdays, a day later. The curve keeps near its average level between the climactic points. It sinks below the average during the two weeks succeeding the menstrual week, and as we approach this period it rises again, becoming in the case of the dream curve a marked climax during the week preceding the period. There is a curious descent in the curves (most marked in the case of the curve *C*) on Monday mornings. This must be due either to the influence of Sunday, or else to the fact that the mind is somewhat anxious as it is about to resume the cares of a new week, which anxiety acts probably as a constant factor in disturbing the completeness of the dream recollection.

It is an open question whether a rise in the dream curve represents increased power of recollection, or increased vividness of dreaming, or increased irritability, or all of these together. We are inclined to believe that the mensal period is at bottom a rhythm of the vital or psychic nature and influences probably all

the activities of mind and body. Hence these activities, when properly observed and measured, become indices of the more fundamental rhythm which they thus indirectly measure, or at least reveal. In the case of the knee jerk reported in the first number of this Journal it was shown how exceedingly sensitive it was in its responses, indicating diverse external and internal conditions and changes. It appears probable that had the experiments been conducted over a sufficiently long interval they would have revealed a monthly rhythm. We also suspect that a great many psychophysic reactions are modified by this rhythm, and the extent to which they are thus subject ought to be determined before we can rightly interpret the results.

Another question which occurs here is this, what sort of a rhythm is the mensal period? There is no fact in nature more prominent than the occurrence of periodicity, and these periods are of almost infinitely varied lengths and variously and complexly compounded. Many periods are secondary and resultant, being dependent on others. In physiology nearly all the periods are in relation to cosmic rhythms, to which they are related not as physical resultants but as vital (or intelligent) responses. The occurrence of the one is a "sign" to the protoplasm to act out the other. Yet we have hinted above that the living being may anticipate the stimulus and react at the proper time, in the absence of the stimulus, and thus have an independent rhythm of its own. How this is done is one of the mysteries of biology yet to be solved. We consider this sexual rhythm as belonging to this category.

When we analyze the figures that enter into the value of the dream curve, we find that several components are active in producing the result. Thus the

occurrence of the ekboles themselves has a modifying influence on the dream value, tending to raise it. But even when all the dream values coinciding with days of ekbole are thrown out and the remaining days summated, the character of the curve is not seriously altered, though of course reduced in value. Let us call the curve thus stripped of its over-tones, so to speak, the *fundamental;* then I found that an ekbole occurring at or near a minimal point had the power to raise the fundamental by a half of its value, but on a maximal point the increment became one fifth of the fundamental value; the average power of increment for all (mixed) cases being one fourth of the fundamental. The ratio of minimal cases to maximal cases, an equal number of each, is 1 : 1.11 in the compound curve, 1 : 1.41 in the fundamental, and 1 : 1.33 in the mixed or normal curve.[1] Although the relative value of the increment is less in the case of the maximal point than in that of the minimal point, the absolute value is about twice as great in the latter as in the former case. This is in accordance with what we should expect. The ekbole causes increased flow of blood to the brain, on the presence of which the dream value so largely depends. This increased flow is relatively more marked when the brain has less blood in it (at minimal points) than when it has a larger quantity of blood (as at maximal points).

When, therefore, an ekbole occurs, the dream value is raised by the ratio 1.25 as an average, and then it falls again to its normal value; but when only

[1] The curves in the plate, *i. e.* those obtained directly by plotting the results of observation, are "normal," or, in the present case, "mixed" where the summation of two sets of values is concerned; one set being unaccompanied and thus unaffected by ekboles, and therefore belonging to the fundamental system, and the other set affected by the presence of the ekboles, and therefore "compound."

one day intervenes before the next ekbole the fall is not so great, the ratio being here 1.10 : 1. The effect of an ekbole to raise the dream value is not so great when it is closely preceded by another ekbole, but in 33 cases presented by our data the ratio of the first to the second was 4903 : 6168 or 1 : 1.25. We shall proceed to show that this ratio, which seems to contradict the last statement, is due to the influence of the fundamental curve. When we analyze the cases more carefully we find that some of them contradict the result we obtained by addition. When these contradictory results are compared with the state of the fundamental curve, we find that in most cases the result has been due to the effect of this curve overcoming the effect properly due to the ekbole. Thus when we know that an ekbole raises the dream value, but we meet a case where a day free from ekbole just preceding or succeeding has a higher dream value, we find an explanation for such a phenomenon when we see that such day is nearer a maximal point than the ekbole day. This law is perfectly plain when we assume that each of the forces acts to contribute its effect independently of the others. The effect of an ascending curve raising all values and a descending one depressing them is readily seen in the tables. Now, therefore, analyzing the above ratio in this way, we have:

	Number of Cases.	Ratio.	Number of Cases.	Ratio.
First day greater than second.	6	1.40:1	12	1.92:1
Second day greater than first.	9	1:3.68	6	1:2.69
	Influence of curve is same way.		Influence of curve is contrary.	

The fact that so many cases show that the first day is the greater even when the influence of the curve is unfavorable leads us to announce the law as above, even though the ratio obtained by summation of all the cases is the reverse. But this ratio is a compound one, and we wish to eliminate the effect of the fundamental. Were we dealing with physical facts accurately determined, we should expect that the ratio 1.40 : 1 in the six cases where the first day is greater than the second (in accordance with the inferred law), when the fundamental assists this result, should be greater than that of 1.92 : 1 where the curve is contrary. This illustrates the peculiarity of physiological data. The element of disturbing influences is so great that exceptional cases are always occurring, especially when the number of cases is small as in this instance. For this reason, though we treat the numbers while performing computations as if they were accurate, we have no right to regard the results as accurate. They may be very inaccurate and even contrary to the truth. But by taking a large number of cases we are justified in regarding the results as *indicators*. Thus no significance can be attached to the particular form of our curves, but they simply indicate that there is a heaping up, as it were, of some influence at the occurrence of the menstrual interval. We should require an infinite number of cases to eliminate disturbances and make our figures have mathematical significance. This point deserves to be kept in mind while dealing with such a problem as this.

We saw above that the length of dreams increases nearly as fast as the increment in the daily record, that is, an average of 100 words must be added to the record to give an additional dream. We have also

seen that the occurrence of an ekbole raised the dream value by the ratio 1.25 as compared with the day preceding or succeeding. When the number of dreams are compared for this case, it is found that there is no difference in the number of simple dreams, but that the complex dreams are increased in number more rapidly than the record. Thus 164 cases of ekbole against their succeeding days gave an average ratio of 2.9 : 1.9. This signifies that the continuity of dreaming is by this influence broken. The fact, I think, is readily accounted for by the process of awakening that often accompanies the ekbole.

We have now to consider the annual variations. Each year contains 13 physiological months. Out of the 30 months from which I plotted the monthly curve, I chose 26 consecutive months for plotting the annual curve. I found that (as our table shows) there was a minimal point at March–April and a maximal point at November–December. The two years are closely similar in these respects. The dream value being the summation of 28 days is to be relied on for a curve, but the ekboles are too few, of course, to give a corresponding gonekbolic curve. We can readily perceive this on inspecting the number and seeing how one year contradicts the other. So we shall leave the ekboles out of consideration and seek to get at the sexual variations in a different direction. The two years combined give us curve *D* of the plate. It is quite plain that at the region of the winter solstice, rather more before than after it, the curve is maximal. It is also plain that the curve is minimal at the time of the equinoxes, the fall being in our curve greatest at the spring equinox. There is a slight rise at the approach of the summer solstice; but when we compare the curves *E* and *F* in these respects our dream

curve seems sadly deficient. It is quite probable that this deficiency is due to the fact that about this time the change of life from the routine of study to the recreations of vacation acts detrimentally to the dream record. Indeed I know by experience that I was not so faithful in my records at this period as at other times.

In the animal and plant world the periods marked by the approach of the two solstices are marked by reproductive activities. This has relation to climate, of course, and not to the astronomical facts directly. The winter is provided against by well protected winter eggs and seeds; and in the case of mammals the gestation period has place during the winter that the young may be born at such a time as to have the advantages of summer. The direct effect of food and temperature in early summer is of course to nourish the reproductive systems, and where the young can be quickly matured reproductive activities are quickly instituted. Psychically the human male feels the approach of summer as a "spring fever," which is probably of sexual significance. To some extent Düsing[1] has worked at this problem and shown that the frequency of conceptions in the human being varies during the year, having maximal points at or near the solstices, but he finds the major climax at the summer solstice, and attributes the other rise in the curve, at the winter solstice, to the influence of the Yule festivities. Our curve *E* is taken from page 98 of his work, and represents the conceptions in Sweden, summated for 1851 to 1855.[2] Düsing also shows us

[1] Die Regulierung des Geschlechts Verhältnisse.

[2] The figures for Sweden do not show the marked climax in June which is true of other countries. The curve is, however, pertinent here, for comparison, as I am of Scandinavian blood.

the interesting fact that as the births increase the increment acts unequally on the production of the two sexes, the girl births suffering more variation than the boy births. Our curve *F* has been plotted from data furnished on pages 298 to 300 of his work. The ratio of boys to girls is given, and this ratio falls as conceptions increase in frequency. We have plotted the variation from the average ratio, and have moreover transposed the plus into negative so as to make the curve parallel with our other curves. It therefore shows variability in the girl births directly and in the boy births indirectly. There is of course no reason why of two variables one shall be rather chosen as a constant than the other. The dotted line represents the average ratio; ordinates above the line represent a fall in boys as compared with the girl births.

Now what seems plain on comparing all these curves is this, that in the monthly period the variation in the dream curve is parallel to that of the sexual curve; that in the annual curves the dream curve is parallel to the curves showing increased sexual activity, and these again to that showing the regulation of the sexual ratio; it follows, then, that we should expect that were a curve constructed showing the variations of the sexual ratio as related to the menstrual period, we would discover an important relation existing between the mensal rhythm and the production of sex. It seems to me the matter is well worth investigating. It has been supposed that the relative ages of the reproductive products and the relative state of "heat" in the sexes influence the sexual ratio, but this seems likely to be complicated by the influence of the sexual rhythm.

The months immediately succeeding the time for which we have summated our data were disturbed by

a trip to the tropics. In this case the approach of the summer solstice was aided by the action on the system of an unusual climate, the result being to vastly increase the record in the region corresponding to Dūsing's major climax. This fact taken in connection with what we stated above tends to show that our annual dream curve is too low for the month of May.

TABLE SHOWING THE RATIO OF INCREMENT IN THE DAILY NUMBER OF DREAMS AND THEIR AVERAGE LENGTH, COMPARED WITH THE INCREASE IN THE DAILY RECORD.

Length of Daily Record in No. of Words.	No. of Days.	Total No. of Dreams.		Average Daily No. of Dreams.		Average Length of Dreams.
		Complex.	Simple.	Complex.	Simple.	
1 to 10	25	0	27	0.00	1.00	5
10 " 20	34	2	55	0.00	1.70	8
20 " 30	43	11	62	0.25	1.50	12
30 " 40	42	21	69	0.50	1.60	20
40 " 50	38	32	51	0.84	1.30	30
50 " 60	29	27	41	0.90	1.40	30
60 " 70	55	68	71	1.20	1.30	30
70 " 80	34	42	58	1.20	1.70	33
80 " 90	39	56	45	1.40	1.15	43
90 " 100	44	76	48	1.70	1.00	41
100 " 120	49	88	73	1.80	1.50	42
120 " 140	54	103	69	1.90	1.30	52
140 " 160	48	103	57	2.30	1.20	52
160 " 180	44	113	56	2.60	1.30	52
180 " 200	32	81	48	2.50	1.50	64
200 " 225	31	90	37	2.90	1.20	65
225 " 250	30	91	32	3.00	1.00	72
250 " 275	26	90	43	3.40	1.70	66
275 " 300	17	54	21	3.20	1.20	83
300 " 350	23	102	19	4.40	0.80	70
350 " 400	20	83	32	4.00	1.60	88
400 " 500	17	72	17	4.20	1.00	107
500 " 900	11	47	12	4.30	1.00	140

*Rule is that ratio of dream value, as averaged for all cases, positive and negative, is 1.25 on ekbole days as compared with non-ekbole days.

TABLE SHOWING THE RATIO OF THE DREAM VALUE ON EKBOLE DAYS TO DREAM VALUE ON DAYS PRECEDING AND SUCCEEDING, AND ANALYZED WITH REFERENCE TO THE STATE OF THE "FUNDAMENTAL."

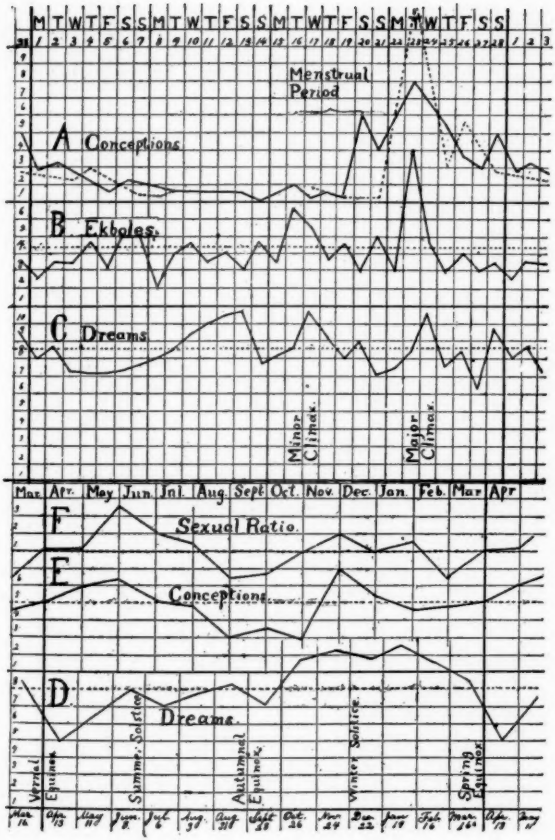
	Dream Value on Ekbole Day is Larger, i. e., Rule* Affirmed.		Dream Value is Smaller or Rule is Negatived.	
	Ratio to Preceding Day.	Ratio to Succeeding Day.	Ratio to Preceding Day.	Ratio to Succeeding Day.
No. Cases.	25	23	16	17
Fundamental Curve is Neutral	2.45	2.47	2.20	2.20
No. Cases.	34	20	19	23
Curve is Auxiliary.	2.90	2.61	2.27	2.06
No. Cases.	19	32	22	16
Curve is Opposing.	2.39	2.42	2.04	1.17

TABLE

Showing the variation in the power of recollecting dreams (perhaps of dream activity or vividness), as measured by the number of words in the dream record, summated for a period of 30 physiological months, from November 24, 1884, to March 13, 1887. The variation in the sexual rhythm, as indicated by the number of gonekboles, is also shown.

Monthly Variation.				Annual Variation.			
No. of Day.	Day of Week.	Dream Value.	Sexual (Ekbole) Value.	No. Mo.	Month beginning.	Ekboles.	Dream Value.
1	Mon.	3405	3	1	Nov. 24	8	4267
2	Tu.	3801	5	2	Dec. 22	5	5090
3	Wed.	3331	5	3	Jan. 19	3	3912 Maximum
4	Th.	3192	7	4	Feb. 16	6	4523
5	Fri.	3152	Pre-climax 4	5	Mar. 16	5	4159 —17792 1st 4 mos.
6	Sat.	3214	8	6	Apr. 13	5	2961
7	Sun.	3347	8	7	May 11	3	2674
8	Mon.	3693	2	8	June 8	1	3053
9	Tu.	4025	6	9	July 6	1	2582 —13047 2d 4 mos.
10	Wed.	4341	7	10	Aug. 3	4	3150
11	Th.	4571	Anticipatory rise 5	11	Aug. 31	4	2746
12	Fri.	4716	6	12	Sept. 28	4	2402 —10880 3d 4 mos.
13	Sat.	4813	4	13	Oct. 26	5	5760 Total for 1885 = 47479
14	Sun.	3589	7	14	Nov. 23	7	4853
15	Mon.	3572	5	15	Dec. 21	4	3627 Maximum
16	Tu.	3969	Minor Climax 11	16	Jan. 18	5	5593
17	Wed.	4999	9	17	Feb. 15	8	3827 —17900 1st 4 mos.
18	Th.	4116	6	18	Mar. 15	4	3507
19	Fri.	3621	7	19	Apr. 12	5	1189
20	Sat.	4034	Here falls the menstrual 4	20	May 10	7	2830
21	Sun.	3135	period 8	21	June 7	5	3790
22	Mon.	3227	4	22	July 5	6	2534 —11316 2d 4 mos.
23	Tu.	3764	Major Climax 18	23	Aug. 2	6	2754
24	Wed.	4741	8	24	Aug. 30	6	3710
25	Th.	3333	4	25	Sept. 27	5	2885 —11883 3d 4 mos.
26	Fri.	3644	6	26	Oct. 25	6	2949 Total for 1886 = 44038
27	Sat.	2770	4	27	Nov. 22	8	4222
28	Sun.	4462	5	28	Dec. 20	7	4581 Maximum
				29	Jan. 17	5	4287
				30	Feb. 14	9	1536*

*Owing to pressure of work, etc., the record for the 30th month was much reduced.


Menstrual Period
A Conceptions
B Ekbolics
C Dreams
Minor Climax
Major Climax
F Sexual Ratio
E Conceptions
D Dreams
Vernal Equinox
Summer Solstice
Autumnal Equinox
Winter Solstice
Spring Equinox

THE RELATIVE LEGIBILITY OF THE SMALL LETTERS.

BY E. C. SANFORD.

When everybody reads, and some do scarcely anything else and the amount to be read increases daily, it is obviously of the highest importance that reading should be made as easy and rapid as possible. If any device of paper or ink or type can shorten the time and lessen the labor even by a very little, the aggregate advantage will far outweigh the trouble, especially as saving is to be expected at the same time in the more important matter of wear and tear on the organs employed. The problem is to get the greatest amount of matter with the greatest ease in reading on the least space; or, as it has been phrased, to get the greatest legibility to the square inch. The problem has many factors, for the result depends on the tint and quality of the paper, on the ink, on the length of the lines and the space between them, on the size of the letters, their proportions, the relation of their light and heavy lines, their distances from one another, and on still other details, all of which are small in themselves, but none of which can be neglected when the question is one of the maximum clearness. And all must be mutually adjusted with reference to the demands of taste and economy. To the typographical factors, Dr. Javal, an eminent French oculist, has devoted considerable study and experimentation, an

interesting account of which, by himself, is to be found in the *Revue Scientifique*.[1] The only other experimental research, so far as I know, which touches the question, is one by Dr. James McKeen Cattell, first published in Wundt's *Studien*,[2] the work upon the letters being incidental, however, to an extended psychometrical study. Dr. Javal tested legibility by the distance at which the letters could be read; Dr. Cattell by the number of times a letter was read right or wrong when seen for a very small fraction of a second through a narrow slit in a falling screen.

In the experiments about to be described the single factor of the letter forms was taken out for study. A standard alphabet has been carefully tested to determine the order of legibility of the letters among themselves, and the groups of letters most liable to mutual confusion. The order of legibility thus reached shows on the one hand what letters are most in need of improvement, and on the other, in a certain degree, upon what clearness depends. The distance and time tests have both been applied, though with apparatus somewhat different from that used by the investigators just mentioned. The distance experiments will be described first.

Apparatus and Methods used for the Distance Tests.

For accurate measurement of the distance a simple instrument was used. It consisted of a wooden rail 3.4 m. long placed before the subject, slanting downward at an angle of about 14°. One end came a little

[1] *Revue Scientifique*, 1881, Vol. XXVII, p. 802.

[2] *Philosophische Studien*, 1885, Bd. III, H. 1, S. 94. The same is to be found in abridged form in *Brain*, Vol. VIII, p. 295; and the part on the letters in *Science*, Vol. VII, p. 128.

below the chin of the subject when seated, the other a few inches from the floor. To the upper end was fastened at right angles a vertical board about four inches wide, and a rough profile cut in this gave support to the chin and forehead of the subject and kept his eye in a fixed position. A little wooden car sliding on the rail carried an upright of wood to which was fastened a movable disk of cardboard. The letters were pasted without natural sequence near the edge of the disk, and a black cardboard screen pierced by a square hole of 2 cm. on the side was tacked on in front. By turning the disk the letters could be shown one after another through the hole at a height above the rail equal to that of the eye. A millimeter scale pasted along the top of the rail marked the distance.

The standard letters chosen were Snellen optotypes of the size D=1.25.[1] The height of the short letters is about 1.8 mm. and of the long about 2.2 mm. The following alphabet is in type resembling that used for experiment: **a b c d e f g h i j k l m n o p q r s t u v w x y z.** The letters were cut from the optotype book with some margin about them, and neighboring letters shaved away so as to leave each letter standing alone and free from the possibly confusing shadows cast at the edge of the paper when cut near the letter. A few experiments were made upon letters from *Mind*, but for them this precaution was not taken, and the screen used was white instead of black. There was nothing in the setting of the letters on the disk to show which extended above and below the alignment except the remnants of a faint pencil line, which, as will appear in the tables, had little or no effect.

[1] The formula D=1.25 means that the letters are of such a size that the short ones subtend an angle of 5′ at a distance from the eye of 1.25 m.

The illumination was as far as possible that of the clear sky. Some alphabets were taken with light of less than full intensity; but in almost every case the illumination was the same for the whole of each, so that no error is to be expected in the *relative* determination aimed at.

Of the five subjects, four were graduate students and one a recent doctor of this University. They will be designated by the initials A, B, H, J, and M. H and A are quite far sighted, J moderately so, B may be taken as normal, while M is near sighted, but by the use of his glasses read at distances not very different from those of B.

Legibility for distance was measured in two ways. By the first the letter-disk was set at fixed distances and the whole alphabet shown in general twice or more at each distance. The first distance used for H, M, and B was 1.5 m., and this was increased 10 cm. at a time till a distance of 3.2 m. was reached. The distances were then correspondingly decreased till all the letters could be read. J went only down the scale from 1.6 m. to 3.2 m., and A only up from 3.2 m. to 1.8 m., after having first seen the letters at a comfortable reading distance. In taking the record the subject announced, when the letter was shown, what he supposed it to be, and his answer was recorded; if he were in doubt he gave the possible letters in what he supposed to be the order of probability, unless all seemed equally probable. In the case of H one other answer was allowed for letters that had become indistinguishable by distance, namely: "One of the small letters; no preference." This method gives us the order of legibility as shown by the number of times each letter was rightly or wrongly named, all distances being taken

together, and at the same time the letters with which each is most confusable when the confusion is caused by distance. These things appear in the following tables.

RESULTS BY THE FIRST METHOD FOR DISTANCE.

TABLE I.

Order of Letters as shown by Percentages of Right Answers.

m 90.9	v 71.0	x 63.0	n 46.2
w 88.1	k 70.9	a 60.8	e 46.2
f 84.4	b 70.4	i 60.6	c 45.1
p 84.3	y 70.4	l 58.6	o 44.9
q 80.9	h 69.9	u 55.2	z 34.1
r 78.7	d 68.3	s 53.0	
j 77.6	g 68.2	t 46.5	

The numbers in Table I are percentages on a total number of answers varying from 291 to 313. The full records of H, M, A, and J were included, and that of B in going down the scale from 1.5 m. to 3.2 m. In the cases of doubt where the answer contained several letters, the letter recorded as having the greatest probability was counted as if it had stood alone, on the ground that if but one letter had been allowed in the answer that would have been the one. Where no difference in probability was recorded, the answer, even when containing the right letter, was counted wrong.[1]

[1] The latter half of B's record was excluded because it shows a large proportion of answers in certain fixed forms: for example, "b or h" for both b and h, or "c or e" for c, e, and o. This came, as B himself recognized later, from his having unintentionally ceased when the letters were almost indistinguishable to report a preference for the one or the other, the single answer being made for all letters of a certain degree of indistinctness. There were five of these forms pretty well marked; "b or h," "c or e," "i or l," "u or n," and "x or z," ease of pronunciation seeming to have fixed the order of letters in the answers, except the last. The part of B's record included in Table I was also, though to a less degree, influenced by the same tendency, and the result would have been, if the answers had

TABLE II.

Showing the Confusability of the Letters as tested by Distance.

m	29	w 52, u 24, n 10, a 7, * 7
w	34	v 53, u 12, m o 6, * 24
f	49	r 37, l 20, j 16, t 10, i 6, * 10
p	36	r 44, y 17, j q 8, g t 6, * 11
q	54	g 30, z 19, s x 7, c n u 6, * 20
r	49	v 22, f 12, s t y 8, c o 6, * 29
j	57	l 25, f 21, i 18, t 12, c 5, * 19
v	61	r 33, t 11, e 8, q 7, * 41
k	88	x 34, h 12, g 11, a 10, b 8, d 6, * 18
b	77	h 45, k 14, a u 10, n 8, * 12
y	69	p 61, r 29, f 6, * 4
h	91	b 51, k 40, * 10
d	69	a g 22, n 9, k o 7, * 33
g	73	r 12, t 10, f 8, a 7, d j o s u 5, * 36
x	96	n 19, z 15, a 9, k w 7, g m o 6, * 24
a	100	u 16, n 14, s 13, k 12, b 9, h 8, e 6, z 5, * 17
i	117	l 58, t 21, j 9, * 12
l	113	i 39, j 36, t 7, f 5, * 12
u	115	a 18, z 12, x 9, n v 8, s 7, g 6, b k o 5, * 17
s	105	n 14, c r 12, i 10, e 9, o v 8, a u 7, * 13
t	129	i 40, s 9, d 8, x 7, l 6, * 31
n	144	a 41, z 12, b 6, h 6, * 35
e	144	c 40, s 11, v 8, r 7, u 6, * 27
c	146	e 34, o 23, u 10, v 9, * 24
o	151	c 34, e 23, a 13, u 11, n 5, * 14
z	144	e 19, s 17, a 16, t 9, o 8, c 8, g 6, * 17

Table II will not be found to tally exactly with Table I, because B's record was here entirely excluded and because all the alternates in cases of doubt are counted in, the object here being solely to show the confusables and their proportionate confusability. The figures as before are percentages, except in the column next the

been counted as those of the other men, to give a disproportionate number of right answers to the letter standing first, and a disproportionate number of errors to that standing last. By way of correction, one half of the number of fixed answers for each letter has been applied positively or negatively as necessary to the letters affected, except to the letter o where one third was used instead. The addition of B's record so corrected to that of the other observers changed the order of letters only as follows: k advanced from behind d to before b, and u and s, q and r, and o and e changed places. The letter d would perhaps have stood a little higher in the list had not B suffered a certain inertia in answering "x or z" for it; this error was not, however, such as could be safely corrected.

letters, where is given the actual number of errors and alternates upon which the percentages are calculated. Letters appearing in the record less frequently than five per cent of these numbers have been regarded as scattering errors and only the percentage of them all together has been given. Scattering errors are indicated by the asterisk. No great weight is attached to many of the confusions which occur more than five per cent of the times, because of the possibility of habit in answering, as explained in the note above.

The Second Method of Distance Determinations.

This method was intended partly to be a check upon the first and partly to fix more accurately the distances at which the letters are just legible. The plan here was to set the car at the bottom of the rail, or beyond the point at which the letter in question could be distinguished, and to have the subject draw it slowly toward him till he was sure what the letter was. Two distances were generally recorded; one the point at which the subject first thought he knew the letter; the other, the point at which he was certain. H, J, and M were tested in this way with the Snellen letters; H and M going over the alphabet ten times each, J five times. Early in the experimentation B and M were thus tested with the letters from *Mind*, B giving eight alphabets, M four.

Owing to the differences of individual eyesight, this method does not give results that can be gathered up in a single table, but the following tables for the single subjects, together with the curves which accompany them, give some means of comparison.

Results by the Second Method for Distance.

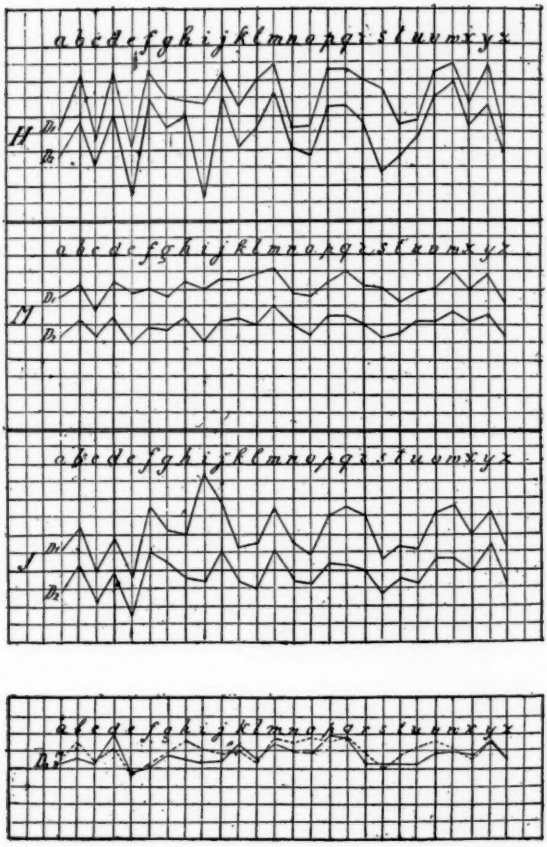
TABLE III.

Showing the Distances in Meters at which the Snellen Letters were recognized with certainty by H, M, and J.

	H.		M.		J.	
	D_2.	M. V.	D_2.	M. V.	D_2.	M. V.
a	1.877	.095	1.326	.122	1.185	.153
b	2.400	.100	1.564	.147	1.560	.117
c	1.788	.113	1.336	.151	1.064	.087
d	2.539	.074	1.593	.166	1.449	.078
e	1.364	.104	1.223	.114	.820	.049
f	2.727	.260	1.450	.110	1.745	.047
g	2.310	.188	1.396	.118	1.628	.111
h	2.473	.136	1.594	.146	1.394	.075
i	1.324	.073	1.262	.139	1.345	.251
j	2.768	.203	1.551	.169	1.722	.107
k	2.076	.151	1.574	.160	1.353	.121
l	2.333	.321	1.499	.176	1.251	.081
m	2.842	.267	1.758	.188	1.778	.131
n	2.049	.116	1.538	.101	1.366	.079
o	1.912	.053	1.334	.114	1.322	.066
p	2.605	.130	1.622	.132	1.588	.116
q	2.628	.124	1.626	.148	1.591	.226
r	2.365	.176	1.505	.139	1.508	.140
s	1.662	.130	1.327	.156	1.181	.048
t	1.856	.068	1.374	.175	1.358	.045
u	2.153	.098	1.545	.171	1.329	.084
v	2.725	.119	1.561	.114	1.703	.125
w	2.953	.206	1.678	.147	1.707	.150
x	2.339	.069	1.553	.124	1.524	.070
y	2.639	.182	1.642	.141	1.852	.122
z	1.940	.116	1.317	.100	1.287	.142

In Table III the columns headed D_2 give the average distances, expressed in meters, at which the letters were recognized with certainty; those headed M. V. give the mean variation of the single quantities entering the averages after which they stand.[1]

[1] The mean variation is found by averaging the variations of the single quantities from the mean, no account being taken of whether the variation is positive or negative.



See note, p. 435.

In these curves the ordinates are averages of distances drawn to a scale of about $\frac{1}{70}$. The curves marked D_1 are those for the distances at which the subject would first venture an answer and did actually answer correctly; those marked D_2 are for the distances at which he knew the letter with certainty, and correspond to the columns similarly marked in Table III. For the letters from *Mind* only the certainty distance was recorded. The separation of the curves D_1 and D_2 for any letter indicates the distance through which the letter had to be drawn to bring the subject from a minimal degree of confidence to certainty. It is the zone in which the letter would in general be guessed correctly. In the case of H this zone would probably have been wider for some of the most legible letters but for the fact that he read them with a certain degree of confidence at the extreme limit of the apparatus.

Comparison of the Results of the Two Methods for Distance.

To facilitate comparison, the orders of legibility for distance arrived at by the two methods are here given:

From Table I,

m w f p q r j v k b y h d g x a i l u s t n e c o z

From Table III,

H. w m j f v y q p d h b r x l g u k n z o a t c s e i
M. m w y q p h d k b v x j u n r l f g t c o s a z i e
J. y m f j w v g q p b x r d h n t k i u o z l a s c e

Letters from *Mind*,

B. d p q m y k n w o g v x h b j l i a t u z r s c f e
M. m q o p h b n v y u d i w k g j r t x a c z l f s e

It will be seen that there is a general agreement in the orders; but at the same time there are some

differences. A perfect agreement is hardly to be expected. As between the order of Table I and those of Table III, a part of the difference is caused by difference in the method of computation. Table I being made from the united answers of a whole series of distances, letters like i which have a wide zone in which they tend more or less to be correctly named would have the advantage of letters like u and n which have a narrower one. For Table III, however, width of zone counts nothing at all. Furthermore, it is not impossible that Table I is still slightly affected by fixed answer forms too little marked to be open to correction; and both tables would be affected, and probably in different degrees, by fixed letter preferences, if any such existed in the minds of the subjects.

The differences of H, M, and J among themselves are in part the result perhaps of optical differences, and in part of differences in the points by which the letters were recognized. H and M, as they have told me, fixed upon the white place between the stem and dot of the i as the sign by which to distinguish it from l, and to see this clearly were obliged to bring the letter quite near; but J trusted to the general smallness of the letter, and this proved at least for him a reliable sign, for he recognized i farther and named it correctly a greater proportion of times than H or M. Something similar may have happened with other letters, though the question has not been investigated.

Another factor which operated probably to a certain extent in both the methods was, strange as it may seem, defective memory of the alphabet. Something more will be said of this in another connection, but it will suffice to say here that all the letters do not seem to be all the time equally present in the mind of the

subject. One or another may fall out for a time and so not be considered in deciding how to name a barely visible letter.

Between the orders for the Snellen letters and those for the letters from *Mind* we may look for differences due to the forms of the letters, the latter being relatively longer and slimmer and having the upward and downward extensions of the long letters about one half the height of the small letters instead of about one fourth as in the case of the optotypes. Taking H's order for the Snellen letters, which is in substantial agreement with that of one or the other of his colleagues for nearly every letter, and B's for the letters from *Mind*, it will be seen that in the latter d, p, q, k, n, o, g and i are advanced; while f and j are set far back, and in a less degree r, w, u and v. The increased length accounts for the advancement of the long letters. The long letters not advanced, except f and j, are b, h, l and y. But y stands already near the head of the list and the other three may be kept back by possible confusions; b and h with each other, and l with i. The i is improved by the increase in height, having more space between its stem and dot. The n and o perhaps are favored by finer lines and larger internal areas of white, but why u should not then be advanced too remains unexplained. The f and j, and perhaps the v, r and w, owe their low position to their narrowness. The orders for B and M are at variance between themselves, and the only value of the latter is the slightly confirmatory one of its agreement with that of B in the advancement of i and the setting back of f, j and w.

So much for disagreements; let us now consider the concurrences. If we divide each series into

three groups of eight, ten, and eight each, we may call those in the left group good, those in the central group fair, and those in the right group poor letters. All the orders from the Snellen letters agree in setting w, m and q in the left, b and x in the central, and z, o, c, s and e in the right group. If we now add to each group those letters that fall in it three times in four we shall have the left group increased by j, f, v, y and p, the central by d, h, r, l, g, k and n, and the right by a and t. Two letters, u and i, occur twice in the central and twice in the right group, but the u's in the central stand third and sixth from the line of division, those in the right section first; the i's, on the contrary, stand only first and second in the central section, but seventh and eighth in the right. We may then fairly put i among the poor letters and u among the fair. This gives us as the final classification w, m, q, p, v, y, j and f as good; h, r, d, g, k, b, x, l, n and u as fair, and a, t, i, z, o, c, s and e as poor.

Relative Legibility and Confusability by the Time Tests.

Methods and Apparatus.

The time test was of the same nature as the first distance test. A certain fraction of a second was chosen, generally between two and six one-thousandths, and the letters were each shown several times for that interval, then another fraction of a second was chosen and the showing repeated and so on. The degree of legibility appears as before in the percentage of correct answers, all the stages being taken together.

The exhibition of the letters for such short periods requires more complicated apparatus than that employed for distance. After some trials of other ar-

rangements the letters were finally set in a dark box and the length of their exhibition controlled by the length of an artificial illumination.[1] The critical point, however, in all such experiments is the measuring machine, and various plans were tried till a happy suggestion of Professor Hall's led to the working out of the instrument used. This has proved in some respects so satisfactory that I shall venture a rather full description of it.

The illumination is controlled by the passage of corresponding notches in overlapping disks driven by a pendulum. The pendulum swings between T-shaped iron columns cast in one piece with the heavy base upon which they stand. The pendulum rod is a steel bar two feet long, an inch and a quarter wide and a half inch thick, and the bob is a lens of lead nearly six inches in diameter. Together they weigh about twenty-three pounds. The shaft upon which the pendulum swings is set in bearings that allow the pendulum to turn clear round over and over. On the same shaft, fastened securely to the pendulum rod, is a brass cogwheel eleven and three-quarter inches in diameter and a half an inch thick. This wheel has 144 teeth and works on each side into a little wheel, less than an inch in diameter, having twelve teeth. The little wheels therefore make twelve turns to every complete turn of the large one. The shafts of the little wheels

[1] The apparatus used by Dr. Cattell has the merit of great simplicity. But the width of the slit in the falling screen through which the letter appeared seems to have been less in the most part of his experiments than the height of the long letters of the type used. Moreover, where room must be left for the movement of a screen before the letter, the eye cannot be perfectly adjusted for distance. In Dr. Cattell's apparatus this was only 3 mm., but under favorable circumstances binocular double images can be gotten from objects 3 mm. apart at a distance of eight or ten inches. The aim of the arrangement adopted was to avoid these difficulties.

run through the ends of the arms of the forward T-column and end in flat brass disks four inches in diameter. The overlapping disks that regulate the illumination are clamped upon these by other free disks of brass which go on in front and are held in position by nuts that screw on to posts in the middle of the first mentioned disks. The overlapping disks are thirteen and three-quarter inches in diameter and of cardboard. As the pendulum swings these two disks move in a direction contrary to its motion and so both in the same direction. Their overlapping sides, therefore, the left side of the right disk and the right side of the left, move in opposite directions; when one moves up, the other moves down, and *vice versa*.

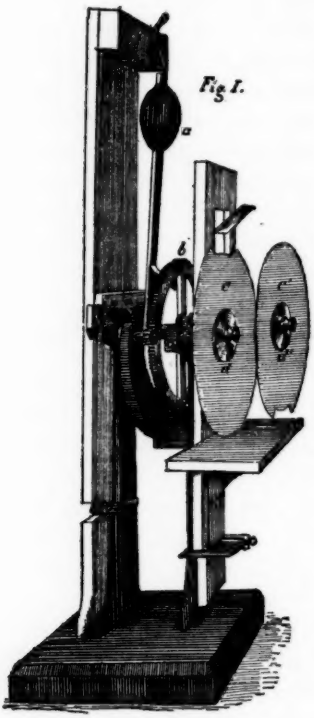
By means of two inclined mirrors the light is caused to pass from behind toward the overlapping edges of these disks. Every time, therefore, that the notches in the disks coincide, the light will shine through for a length of time depending on the width of the notches and the rate of the disks. For every complete circuit of the pendulum, however, there would be twelve coincidences and twelve flashes of light, were not all but the shortest one cut off by another disk behind these two. This is about seven inches in diameter and is moved at the same angular rate as the pendulum by a set of two and a half inch gears, one on the main shaft of the pendulum and one on the shaft of the disk. A notch in its edge allows the light to pass during that portion of the circuit of the pendulum in which the shortest coincidence of the notches of the large disks occurs, and cuts it off at all other times.

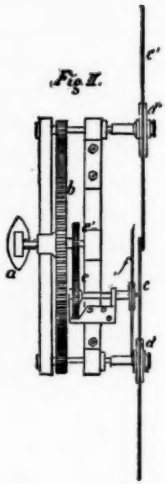
The rate of the pendulum, and with it the angular rate of the disks, is kept constant from one fall to another by letting the pendulum start each time from

a fixed point. For this purpose a stout plank is fastened to the rearward column, and near its top, but a little to one side, is fastened a trigger catch. In using the machine the pendulum is brought up into position against the catch and the trigger pulled; it then falls with great swiftness and rises again on the opposite side of its arc to a nearly vertical position, where it is caught by the hand and pushed on till it rests again on the catch and is ready for another fall. Since, then, the rate of the disks is the same each time, the length of the illuminating flash can be varied by varying the width of the notches. It would no doubt have been possible to use permanent disks with some mechanical device for opening and closing the notches, or to have reached the same end by dropping the pendulum from different points on its arc, but it seemed better in this study to make a number of sets of disks with notches of varying width and to change the length of the flash by changing the disks. The accompanying cuts will help to make clear the construction of the machine.[1]

The width to be given to the notches for any particular fraction of a second is measured by making a tuning-fork write upon smoked paper fastened upon the brass disk mentioned above as clamping the cardboard disks. The fork is attached to the armature of an electro-magnet and the pendulum can be made to close and open the circuit in its fall. The fork is thus made to write for a little more than a single turn of the disk, the turn chosen being that in which falls the illuminating flash. In this way it was found that this turn of the disk is made in less than 0.07 of a second, and that an angle whose arc measures ten eighths of an inch on a circle thirteen inches in diameter is passed over in about one five-hundredth of a second; or, since the overlap-

[1] See pages 418 and 435.





ping edges of the disks move in opposite directions with equal speed, notches of this width in both will pass one another in one one-thousandth of a second. From this as a unit any required interval may be laid off; for the rate of the disks is sensibly constant for several consecutive thousandths of a second. A certain error was to be expected from the play of the wheels when the pendulum crossed the lowest point of its arc. This might have been avoided by making the coincidence

of the notches come before the pendulum reached that point, but in the first tracings taken the error was hardly noticeable. The extreme variation from all causes in that part of the turn covered by the notches, as estimated from 81 tracings taken at different times during the experimenting, was about one part in eighteen. The instrument might, perhaps, be criticized on the ground of its noise, but this is a constant factor and the subject soon becomes completely oblivious to it.

The dark box was of simple construction, about fifteen inches square and nine deep, and was set obliquely before the machine. The letters were pasted as before on a cardboard disk, and were immediately behind a centimeter square opening in a black cardboard screen at the back of the box. The disk could be turned from behind through a hole in the box. The place of the letter was indicated by pinholes pricked near it; at first by four, later by three. The illuminating flash entered the box by a cardboard tube and fell on the letters at an angle of about 40°, while the subject looked perpendicularly upon them at a distance of sixteen inches. A certain quantity of extraneous light entered the box in various ways, sufficient often to make the white square about the letter dimly visible to eyes thoroughly accustomed to the dark, but never, of course, sufficient to disclose the letter.

The light used for the illuminating flash was from a free-burning gas-jet re-enforced by a plane reflector. The total distance traversed by the light in reaching the letters was about three and one half feet, and in its course it was twice reflected. Its intensity was therefore not great, but that is of little consequence in the present instance. A more serious disadvantage was

the quivering of the flame, which was an undoubted cause of variation in the reading of the letters, but the number of exhibitions of each letter makes its effect inconsiderable in the final result.

As before, the Snellen letters were those most thoroughly tested; the tables for them rest upon a basis of two hundred exhibitions of each letter. A second set of letters of nearly the same dimensions, but of somewhat different shape (heavy faced old style), and including as extra forms the small capitals A, E, L, and T, and a long s, was exhibited eighty times.

The following alphabet is in type like that used, but smaller:

a	b	c	d	e	f	g	h	i
j	k	l	m	n	o	p	q	r
s	t	u	v	w	x	y	z	

The small capital A was made by inverting a v; the E had its backward extensions trimmed away; and the T, L, and long s were made from parts of other letters, the latter from the tails of two j's.

The subjects were doctors and graduate students of this institution, except C, who is a boy about fourteen years old. The number of alphabets furnished by each was as follows: For the Snellen letters, C, 5; H, 38; J. H, 18; J, 23; L, 45; M, 26; S, 21; U, 24; and for the other alphabet, H, 11; J. H, 12; J, 12; L, 11; M, 12; S, 13; U, 9. The lengths of time for which the letters were exhibited varied with the individual; records taken with H, for example, from 0.0013s. to 0.004s. are included in the table for the optotypes, and with J from 0.002s. to 0.006s.[1]

[1]Absolute exactness is not attached to these times, though they are approximately correct. It is sufficient for the purposes in view that the time should be the same for each letter of the alphabet. As measured by the width of the notches the figures are probably slightly too small; but, on the other hand, while the notches are passing each

Results by the Time Method.

Table IV corresponds to Table I, except that the percentages of wrong answers and of the times when no answer was ventured are added.

TABLE IV.

Snellen letters:

	Right.	No Answer.	Wrong.		Right.	No Answer.	Wrong.		Right.	No Answer.	Wrong.
m	82	7	10	f	58	6	36	o	39	17	43
w	73	1	25	b	52	11	36	u	38	13	48
d	67	7	25	l	49	8	42	a	35	15	49
q	66	5	28	i	48	15	36	n	34	8	58
v	63	7	29	g	47	13	39	e	33	20	46
y	62	5	32	h	47	9	43	s	27	21	51
j	61	12	26	r	43	11	45	c	26	14	60
p	61	7	31	x	42	16	41	z	23	19	57
k	61	7	32	t	39	15	45				

Old style letters:

	Right.	No Answer.	Wrong.		Right.	No Answer.	Wrong.		Right.	No Answer.	Wrong.
m	90	2	7	j	56	6	37	a	32	21	46
w	82	6	11	r	55	7	37	t	31	16	52
p	79	1	20	l	54	10	36	f	30	20	50
q	74	10	16	o	52	14	34	s	29	24	47
v	70	7	22	n	45	14	41	x	29	21	50
y	67	5	27	i	42	16	41	z	27	24	49
k	64	2	34	g	41	22	36	c	26	29	45
b	61	16	22	h	40	10	50	e	14	24	62
d	56	17	26	u	37	16	46				
ſ	45	9	46	L	22	31	46	E	5	26	69
A	39	15	46	T	6	20	74				

other, the chink through which the light shines opens from nothing to the full width of the notches and then closes to nothing again, thus giving at one end of the interval a phase of increasing and at the other of decreasing light, which would shorten by a small amount the time for which the letter is really visible.

Dr. Cattell found with his apparatus and letters of the same size that half of the alphabet was read correctly with an exposure of from 0.0011s. to 0.00135s.; in this study it was found that from 0.0017s. to 0.004s. or 0.005s. was necessary for an equal proportion of correct

Table V corresponds to Table II in calculation and arrangement.

TABLE V.

Snellen letters:

a	116	n 18, s u 14, e 11, g 6, c z 5, *24	n	130	a 34, u 14, q 6, h 5, *41
b	85	h 24, a 11, n k 8, o 5, *41	o	105	e 32, c 26, a 9, q 7, *27
c	140	o 25, e 24, r 6, *44	p	70	y 17, g 14, q 10, b e n o 6, *36
d	57	a 28, g n 7, l m q u 5, *37	q	69	d g 14, o 13, a 9, b c n s u 6, *20
e	113	o 25, c 16, d 8, g 7, v s 5, *33	r	100	y 14, f g 12, p t v 8, i 7, z 5, *26
f	84	l 21, i t 14, r 13, j 8, g 6, *27	s	121	a 19, e 14, o z 11, g 8, *37
g	90	a s 17, z 12, k 9, d 8, x 6, *32	t	112	i 28, l 18, f 11, j 9, r 8, y 5, *21
h	101	b 44, k 13, a 10, n 8, *26	u	109	n 21, a 19, e 9, c 7, *43
i	87	l 39, t 17, j d 9, *25	v	71	r 25, y 18, e w z 6, *39
j	62	l 47, d 11, i 10, g 8, y 6, *18	w	55	v 16, n r 9, a g u 7, e m s 5, *27
k	69	h 20, g 12, x 10, a 9, y 7, n 6, *36	x	91	k z 20, n 12, a 10, g 7, *32
l	97	i 44, j 19, t 8, d y 6, *16	y	71	g p 15, r 14, q 11, v 8, f 7, *28
m	28	o w 18, a e 14, k n x 7, *14	z	124	s 23, g 17, a 12, x 8, k 7, *34

Old style letters:

a	46	n 17, u 11, o 9, c d e s x 7, *30	n	37	p 19, a 16, u 11, o 8, b q r s t 5, *19
b	23	h 26, k p 13, t u 9, *30	o	33	e 27, c 15, a b p 9, x z 6, *18
c	40	e 15, r 10, g k t 8, a n u E 5, *33	p	17	g E 18, q 12, b e i l r t u w *f* 6
d	21	a 19, j 14, g l u 10, *38	q	16	o 19, c s E 13, d e g r u v A 6
e	53	c 24, r 9, n s z 8, u 6, *38	r	34	f 35, i v 18, l 6, *24
f	41	i 24, l 17, *f* 15, j 12, t 10, *22	s	45	a 16, n 13, c z 11, e x 9, g h 7, *18
g	34	n 15, z 12, a h E 9, d g q x 6, *24	t	45	i 27, l 22, f 11, j 9, k 7, *24
h	50	b n 32, p 8, *28	u	48	n 19, c o 15, e 10, b 8, z E 6, *21
i	37	l 30, j 27, t 24, f 11, d 8	v	23	w 22, o 17, y 13, c e q 9, *22
j	35	l 40, *f* 26, i 20, *14	w	10	E 30, a 20, m n o u v 10
k	37	h 22, t 16, b l s 8, f g l 5, *22	x	45	z 18, k 13, a 11, s 9, v 7, *42
l	31	i 35, j 29, t 16, f z 6, *6	y	25	v 28, p 20, n u 8, *36
m	8	w 50, e n z L 13	z	44	x 20, s v 9, g r y 7, *41
A	42	a 38, e 12, c n 7, *36	*f*	40	j 40, f 28, l 15, i t 5, *8
E	61	a 11, m 10, s z 8, g k r 7, *42	T	64	r 55, v 8, l t y 6, *19
L	41	t 27, b 22, *51			

answers. Two reasons for this difference are clear, namely, that the illumination used here was much fainter, and that the retinas of the subject were each time before the illumination in an approximately unstimulated condition (*vide* Wundt, *Phys. Psych.* 3 Aufl. II, 267). There is, moreover, a peculiarity in Dr. Cattell's apparatus which may render the figures less comparable than might at first appear. The slit in his falling screen had to be 1.3 mm. wide to pass over a given point in 0.001s. The long letters are, however, 2.2 mm. high, and the length of time from the instant in which the top of the letter first became visible to that in which the bottom of the letter ceased to be visible must have been 0.001s. plus the length of time required to pass over the letter, which was about 0.0017s. Any particular point of the letter was therefore seen for 0.001s., but the whole letter was in the process of being seen for 0.0027s.

These tables are subject to the same disturbing influences and therefore to the same criticisms as their parallels for distance, and as before, some of the confusions represented as possible owe their prominence to individual peculiarities of the subjects.[1]

The order of legibility for time, in spite of some variations, is in substantial agreement with that for distance. For the sake of comparison these are given below, together with that given by Dr. Cattell.

Order for time, Snellen letters,

m w d q v y j p k f b l i g h r x t o u a n e s c z

Order for distance, Snellen letters, combined result,

w m q p v y j f h r d g k b x l n u a t i z o c s e

Order for time, old style letters,

m w p q v y k b d j r l o n i g h u a t f s x z c e

Order for distance, letters from *Mind*, B's record,

d p q m y k n w o g y x h b j l i a t u z r s c f e

Order of letters for time, given by Dr. Cattell,

d k m q h b p w u l j t v z r o f n a x y e i g c s.

By a strange bit of perversity several of the worst letters fall in the number of those most frequently used. In a full font of type the eight letters most largely represented are as follows:

e 12000	a 8500	n 8000	s 8000
t 9000	i 8000	o 8000	h 6400

[1] Another test of legibility would be to present the letters to the eye in indirect vision. This is especially worthy of trial because in normal reading the eye does not pass at a uniform rate from letter to letter, but flits from word to word, almost from phrase to phrase, judging many letters in the indirect field. It is hardly probable, however, that it would show results essentially different from those for distance and time. The connection of rapidity in reading and the indirect field has been demonstrated by the experiments of Dr. Cattell, *Mind*, Vol. XI, p. 64.

What Points of Form Help and What Hinder Legibility.

It can be said *a priori* that legibility will be favored by enlarging the size and increasing the differences of the letters. And it is easy to show also that legibility is favored by simplicity of outline and concentration of the differentiations upon one particular. The influence of size is clear from the composition of the left groups in the alphabets of the last section, where it also appears that breadth is as great an advantage as length. With most of the letters breadth is rather more of an advantage, other things being equal, than length, for it gives some visibility to their internal spaces; and Dr. Javal is undoubtedly right in prefering short broad letters to long and narrow ones. The differences necessary to legibility have been neglected by the makers of phonetic alphabets, in their desire to indicate phonetic similarity by similarity of form. If such alphabets are ever to come into general use they will certainly have to be improved in this respect. Simplicity of outline, or what is the same thing, solid areas of black and white, will be found in most of the letters of the left groups. It may even compensate for small size, as is shown by the legibility of v. In accordance with this principle, the ceriphs, or little finishing strokes of the letters, for example at the top and bottom of h and the ends of s and z, should, as Javal recommends, be made short and rather triangular than linear in shape. They are really more important in protecting the tips of the letter from the rounding effects of irradiation than in giving it a finished appearance, and should therefore be as small as possible and yet accomplish that object. When they are too long, as is certainly the case with the Snellen letters, they

easily lend themselves to confusion. The concentration of differentia is well seen in the group b d p q, where each of the letters is made of a straight stem and a loop, the whole difference being made in combining the two. All are very legible letters except b, which suffers from confusability with h.[1] An example of lack of concentration is found in g and a, which have few points in common with other letters and yet are mistaken for many different ones.

The element of size cannot be used to improve the relatively poor letters without at the same time shocking taste and opening the way for new confusions. It is therefore from simplification and emphasis of the points of difference that help is to be expected. In the c e o group, for example, the point of distinction of c and e from o is the gap in the side, and Javal is right in proposing a return to the more open forms of the earlier type-founders. He suggests two forms for e; one like that in the "old style" letters above with the cross line near the top, and one in which the cross line is made longer and more prominent by an oblique position, thus, *e*. It would appear from Table V that the first of these is about as confusable with c as the common form is. The advantage of the wider openings of the c and e appears in the less percentage of confusion with o, as shown by a comparison of the second part of Table V with the first and with Table II. The two forms of the Greek epsilon, ϵ and ε, and an E, made with square corners like the capital to distinguish it from c, suggest themselves as possible substitutes. The result of the tests for the latter is given in the

[1] The difficulty which has made a proverb of "Mind your p's and q's" is the difficulty of naming each correctly, and not that of recognizing their forms as different.

second part of Table IV, where its extreme illegibility is strikingly demonstrated. All the letters added suffered somewhat from ignorance on the part of the subject of their exact form and from a tendency to let them drop out of memory in answering, but E is the worst of the five. In Dr. Cattell's experiments on the capital letters E proved worst of all.

Another group of the poor letters includes a, n, and u. The distinction of n and u from each other and from a ought to be helped by keeping their openings at the top and bottom as open as possible, and the slight advantage shown in this particular by the second half of Table V over the first may be due to the wider openings of the "old style" letters. Dr. Javal points out the curved top of the a as a point of resemblance to n and recommends a form of the first letter found in the Italian manuscripts that furnished the model for some of the early typemakers. In this the top is very small and the loop is relatively long horizontally, giving the letter the appearance at a distance of an inverted r : ɹ. Even in the less exaggerated form which the letter would be given if it were adopted, it could easily be distinguished from u and n; and from s also, with which it has some tendency to confusion. The great legibility of v suggested that its inverted form, small capital ʌ, might be substituted (after the analogy of c, o, s, v, w, x, and z) for the present a, and it was tested with the "old style" letters. Table V shows a slight advantage for it in spite of the handicap of the added letters. Strangely enough, the letter with which it was most frequently confused was the a-form now in use; had that been omitted it might have stood considerably higher in the list.

Dr. Cattell says that s is "hard to see"; and the

number of times no answer at all was ventured for it, together with the wide scattering of its confusions, show him to be right. Dr. Javal, too, thinks it rather a hopeless case, but suggests the sharpening of its angles as a way of making it approach the legibility of z. In the s of the "old style" alphabet this has been done to a certain degree and the letter made relatively a little larger. As long as the present form is retained something of this kind is probably all that can be done. Tests were made, however, on a long *ſ* with the satisfactory results shown in Table V. The long s that is so much like f should of course be avoided, but great legibility is to be expected from a form that extends both above and below the line; it would at least put confusions with z and a out of the question.

The group with which this form of s is most prone to confusion is the long, narrow group, f, j, i, l, t. Of these f and j are good letters when the projections at the top of one and the bottom of the other are made heavy and long enough, as shown by the superiority of the Snellen f and j over the same letters in the alphabet from *Mind*. It is preferable if the s confusion is to fall anywhere that it should be on these letters rather than on a and z. The other letters of the group are not nearly so liable to confusion with the long s as with each other. Dr. Cattell suggests λ for l and suppression of the dot of the i. Dr. Javal would shorten the t and prolong its cross toward the left (this, however, chiefly to distinguish it from f, the cross of which is to be prolonged the other way); and he would set the dot of the i as high above the stem as possible, at the same time making it heavy to avoid breakage, and thickening the stem to match. The value of Dr. Cattell's suggestion for l is doubtful. The letter suggested

is totally foreign to our Roman alphabet, and very possibly would be confusable with b and h as y is with p. Removing the dot from the i would certainly make it more legible when standing alone, but much more confusable when with other letters in a word. Twice when for a few weeks I had the matter in mind, my attention was called to i's in print accidentally deprived of their dots; in one case l and i together made a tolerable h; in the other the loss of the dot turned "ruin" into "rum." The small capital forms for L and T were put to the test with unsatisfactory results, partly due perhaps to the fact that the letters were made from parts of other letters set together. The t difficulty could probably be solved as Javal suggests, and the distinctive point of the i, the separation between the dot and stem, could be emphasized by making the stem shorter than the rest of the short letters, though this would hardly be tolerated from an æsthetic point of view.

The confusion of x and z and of s and z would be lessened by reducing the ceriphs to the lowest possible limits.[1]

Into the remaining confusions of Tables II and V it is hardly profitable to go, but it may be added as explanatory of some of them that a difference of size was

[1] If acceptability is entirely neglected, it is not hard to suggest geometric forms of great probable clearness to replace some of the forms of the present alphabet. A cipher alphabet which fulfils the conditions in a high degree is found on page 291 of the *Revue Scientifique*, Sept. 3, 1887, where it is attributed to the Freemasons, though the same has been shown the writer as once current among the pupils of an American school. The letters are all made from the lines and spaces of the set of crossing parallels used in playing "tit-tat-to" together with an ×; the upper left hand angle giving a, the same with a dot in it b; the next three-sided square standing for c, or with a dot in it for d, and so on. The letters are all made with straight lines and large open spaces. The dotted forms are of course not as good as the empty ones, and some of these are found in developed shape in our present alphabet, but others remain to be utilized if necessary.

sometimes perceived which failed of interpretation; for example, the answer y when r was the letter might be "y minified," or when o was guessed for d or b, "o magnified." Again, confusions of letters which in ordinary print extend, the one above, the other below the line, appear in the tables, but may be safely called impossible in actual reading. It might be questioned, too, whether tables made up for all degrees of distance and time show those confusions most to be feared under ordinary circumstances. But a collation of the errors made at the shortest distances and the longest times with those of Tables II and V shows a substantial agreement for most of the letters, and for most of the remainder the changes are only in the relative importance of the confusions. There is a tendency for unusual ones such as d for j and q, and g for r, to drop out; g shows a good deal of variation; a and s tend at the shorter distances to confuse a little more with each other than with other letters, but for longer times the reverse is the case if there is any difference; x is somewhat more likely to be called z or k, and less likely to be called n; and so with the other letters that show differences in order; but in the main, and especially for the letters most in need of correction, the table represents nearly enough the errors liable to occur in ordinary reading of letters like those tested.

The letters were chosen as being to a certain degree typical and furnishing a fair point of departure for investigating other letter forms, but generalizations from them must be made with caution. To settle finally and in detail just what letter form is to be selected as most legible would require a very long series of tests, in conditions as near as possible to those of normal reading, upon many existing and possible variations of each letter.

Physiological and Psychological Incidents.

The unusual conditions under which the eyes were used in these experiments brought to notice two or three optical phenomena, a description of which will help to explain some of the confusions found in the foregoing tables and may be interesting in itself.

At the longer of the distances used in the tests by distance, the letters appeared as dark grayish dots, and were recognized, if at all, chiefly by their outer configuration. These dots did not seem, however, to maintain one fixed and constant form ; but on the contrary, while the subject strained his eyes to make one out, first one letter and then another would take form in it. This any one can try for himself by setting up a letter at a distance considerably greater than that at which it can ordinarily be read, and studying it intently. It would be extremely interesting to decide where the cause of this shifting and interchanging lies, whether in the apperceptive centres or in the retina. Every one knows the ease with which expectant attention perceives what it expects, and it may be that the variation in the letter dot is only a parallel and index of the movements of attention from one mental letter-image to another as they pass into the focus of memory. On the other hand, it might be in part at least a retinal matter. The average diameter of the cones in the fovea corresponds nearly to an arc of one minute in a spherical field of view; the square letters of the optotypes therefore, at a distance of 1.25 m., lay upon from twenty to twenty-five cones, and at the end of the rail on about four, and the other letters in proportion. Now if these retinal elements undergo more or less rhythmic changes (from fatigue and recuperation or from any other cause),

which are not entirely synchronous among themselves or with those of the other eye, it would give a basis at least upon which the attention could construct the changes of image described. The phenomenon is something like that of binocular rivalry, and like that, waits its final explanation.

In some of the time tests binocular effects were discoverable, but what there was to hinder exact convergence of the eyes it is hard to see. Such answers, however, as $ for t, 9 for b, ♀ for p or q, "a monogram of a and q" for q, "m with four strokes" for m, "two capital A's side by side" for A, show it beyond question, and no doubt some of the answers of w for v and of q for p should be attributed to the same cause. Such answers as the third and fourth would indicate that both eyes do not always see all parts of the letter with equal distinctness.

Another singular thing noticed when the letters were momentarily illuminated points the same way. A part of a letter would sometimes be seen normally solid and black, while the rest of it appeared faint almost to extinction; thus an h would have a solid body like an n, but a stem sketched in outline. In this way probably came the answers of o for q in both parts of Table V, and of n for h and v for y among the "old style" letters. Answers of this kind are to be found in Dr. Cattell's table of confusables in the *Studien*. They are so clear indeed that the conclusion seemed at first unavoidable that the narrow slip used by him had caused guesses to be made when only a part of the letter had really been visible at the instant when the attempt was made to see it. But this clearly cannot be the cause in the present instance. The phenomenon was not confined to the long letters, but cannot so

easily be shown from the table for the others. There hardly seems room here for a psychological explanation; but if for any reason one of the eyes received the whole h form and the other only so much of it as is like n, the different appearance of the stem and body of the letter would not seem strange. But this would require a different excitability of the retinal elements among themselves in one retina or the other, and in so far, if justified, would give a presumption in favor of at least a retinal factor in the variability of the letter-images before mentioned.

With the instantaneous illumination a curious illusion was brought out. As described above, the place of the letter was indicated by a small rectangle or triangle of pin holes showing as bright dots, and the letter itself was seen just behind a square hole in a black screen. When the letter was set accurately at the centre of the square it appeared, with reference to the dots, as it actually was; but when, as sometimes happened, the letter and its dots were turned too far or not far enough, so that the letter stood at one side of the hole in the screen, it was seen as displaced with reference to the dots also, and in the same direction as with the square. Attention to the illusion tended to destroy it, but otherwise it could be repeated almost at pleasure. It seems not to be of binocular origin; at least it has several times been obtained monocularly in a few tests made to try that point. The thing is difficult to account for, and no conjecture will be ventured at present.

It has already been said that unequal recollection of the letters of the alphabet has probably affected the tables given. The temporary dropping out of a letter has several times been noticed, and a few times its

return has been so sudden that the subject has exclaimed that he had been forgetting such and such a letter. The writer himself read d correctly a number of times at rates from 0.003s. to 0.005s., but at 0.006s. named it wrongly the three times it was shown, and only guessed it once in the whole set for any other letter. But a much more marked case was that of M, who, in thirty-five alphabets taken with the Snellen and "old style" letters at intervals from December 29 to the last of January, read c correctly but twice and made it but twice as a guess for some other letter, and during the same period never answered e at all; but on February 11, in three alphabets, taken to be sure with a little longer illumination, he read e correctly three times and guessed it twice for c. He showed no aversion to these letters in the distance experiment.

A certain hindrance to this dropping out of letters, at least for the distance tests, was interposed by the repetition of the whole alphabet; this is shown in the part of B's record omitted. The time being limited in which to take observations with decreasing distances, I thought to shorten the work by ceasing to present a letter as soon as it had been correctly read a certain number of times. At the distance 2.3 m. I omitted, without the knowledge of B, the letters f, g, m, q, r, w, and y. The omission of y had a strange effect on p, which I still continued to give. At 2.4 m. p was rightly named the three times it was shown, but from 2.3 m. to 1.9 m. it was constantly called y, and even at less distances did not escape confusion with that letter. That is to say, we have p, by right one of the clearest letters, mistaken for y, when z, t, n, u, and l were read and a, c, e, i, o, and s the only letters in doubt. The withdrawal of the corrective to the mental y-

form furnished by the actual y, and the dropping of p from the focus of memory, allowed the return of the y-confusion that had attended p at greater distances. The time covered by these experiments was about two hours. These facts make it appear that in the "letter habit" there is a variable factor which would have to be accurately determined before the law of probabilities could be applied to the letter-guessing tests for telepathy and the like.

The effect of practice is evident in the records for both distance and time. H was able to recognize all the letters with certainty at 1.5 m. when he began, and at 1.8 m. when he ended. M. was in doubt about c, e, and o at 1.5 m. when he began; on returning, the letters were brought no nearer than 1.9 m., where he recognized all the letters except c, j, o, and z; the errors for all but o being, however, but one each in seven or eight trials. B's record in general shows something of the same kind. The gain at this point measures the gain in distinguishing the worst letters; the better letters do not show so much, and a few were recognized on decreasing the distances only at a nearer point. The following averages of the distance for the eight alphabets from B's record on the letters from *Mind* show the gain for the alphabet as a whole: 0.935, 0.995, 1.076, 1.010, 1.090, 1.101, 1.240, 1.161. These were B's first trials with the letters. The first six were taken two a day on successive days, the last two after an interval of some weeks; the last is lowered somewhat through a loss of confidence. The table below gives the actual number of right and wrong answers and of the times when no answer was returned for the first twelve alphabets taken by the time method with J. H. The letters were the "old

style," including the five added letters; the time was 0.004s.

Right.	No Answer.	Wrong.	Right.	No Answer.	Wrong.
3	22	6	11	4	16
3	16	12	12	4	15
2	23	6	10	7	14
4	17	10	13	6	12
5	11	15	15	4	12
8	6	17	16	2	13

The first eight or nine alphabets taken on each subject were thrown out in making Tables IV and V by way of allowance for practice.

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p. 410. By an error of the draughtsman the ordinates of the curves for H are too short by four spaces and those of the curves for J by two. The curves in the lower diagram are those for B and M with the letters from *Mind*.

p. 418. The letters in the cut indicate parts as follows: *a* the pendulum, *b* the large cogwheel attached to it, *c* and *c'* the notched cardboard disks, *d* and *d'* the free brass disks clamping the last in place. In Fig. II *e* and *e'* are the two-and-a-half-inch gears, and *f* is the third disk which moves at the same angular rate as the pendulum. One of the mirrors is to be seen inclining forward above and behind the cardboard disks. Fig. I represents the machine ready for the fall of the pendulum.

WINTER ROOSTING COLONIES OF CROWS.

C. L. EDWARDS.

Crows constitute one of the most sagacious, gregarious, and omnivorous genera of birds. Throughout their wide distribution they form colonies which may be either small and of the family nature, where the crows do not migrate but live together throughout the year, or of large aggregations, composed mainly of migrants collecting together for the winter. In this country their winter colonies are found at or about 40° N. latitude along the Atlantic coast and in the valley of the Mississippi. They are so populous and so well organized, and their roosts so permanent, that they afford one of the best fields for the psychologist to study the manifestations of the social instinct. Although various phases of their gregarious habit have been recorded by a number of observers, there has hitherto been no systematic attempt to present the topic as a whole, including study of individual colonies, the number of colonies, with a general conspectus of the American literature and legislation upon the subject, such as is attempted in this preliminary report, to be followed by more detailed study of special phases later.

The importance of the topic for all interested in what, since Palmén and Beard, might almost be called the philosophy of bird migration, or in the study of those

remarkable social organizations our knowledge of which has been so well compiled by Espinas and which has been so suggestive to so many writers, or in the social organizations of mankind, is obvious.

Although throughout New England and New York crows are found as winter residents, and roosting colonies of several hundred individuals have been reported, yet the large majority of crows migrate southward to spend the winter. Audubon[3] says they "become gregarious immediately after the breeding season," forming large flocks which towards autumn remove to the Southern States. Dr. C. Hart Merriam tells me that in New York, soon after the nesting season, as early as July and August, the crows collect in flocks which gradually increase in size until numbering several hundred individuals. In October these flocks migrate, and with the crows indigenous to our more southern territory, form the winter colonies.

These colonies have been reported from Delaware, New Jersey, Virginia, Pennsylvania, and Maryland, in the East, and from near St. Louis, Missouri, Kansas, and Nebraska, in the West. Mr. Rhodes[6] gives a list of fourteen roosts: eight in New Jersey, two of which are now in use, the others having been deserted from two to forty-five years; four in the Delaware River, one of which, Reedy Island, is now in use, the others deserted from twenty to seventy years; and two in Pennsylvania, one of which is in use, the other deserted eight years.

The literature of crow roosts is not very extensive. The most historic is the Pea-patch, described by Wilson,[1] "near Newcastle, on an island in the Delaware . . . a low, flat alluvial spot of a few acres, elevated but little above high water mark and covered with a

thick growth of reeds. . . . It is entirely destitute of trees, the crows alighting and nestling among the reeds, which by these means are broken down and matted together." The colony was once destroyed during "a sudden and violent northeast storm" by the tide flooding the island. Wilson continues: "This disaster, however, seems long to have been repaired, for they now congregate on the Pea-patch in as immense multitudes as ever."

According to S. W. Rhodes[6] this historic roost, the condition of which Nuttall in 1829 did not know, "was abandoned soon after the construction of Ft. Delaware was begun in 1814, and . . . the crows betook themselves to Reedy Island as the most convenient substitute." Nuttall[2] first tells us of the colony at Reedy Island. Mr. George W. Jones, keeper of Reedy Island lighthouse, in a report kindly sent me by Dr. C. Hart Merriam, says: "The island, one mile from the mainland, opposite Port Penn, Del., is two miles long and contains about sixty-five acres of marsh land. There are no trees or bushes, but the reed grass grows very thickly upon the island. The crows occupy about twenty acres, breaking down the reeds, which are from seven to nine feet tall, and roosting upon the broken stems."

Dr. John D. Godman[4] has left some valuable observations upon the crow, and as he lived for a time in Anne Arundel County, Md., only three or four miles from the Arbutus roost (described later), it was no doubt the ancestors of these crows that he observed. "The roost is most commonly the densest pine thicket that can be found, generally at no great distance from some river, bay, or other sheet of water which is last to freeze or rarely is altogether frozen. To such a

roost the crows, which are during the daytime scattered over, perhaps, more than a hundred miles of circumference, wing their way every afternoon and arrive shortly after sunset." Mr. S. W. Rhodes[6] gives personal observations of a colony near Merchantville, Camden Co., N. J., which occupies oak trees twenty feet high, covering fifteen or twenty acres of ground.

Dr. Coues[7] says: "In settled parts of the country the crow tends to colonize, and some of its 'roosts' are of vast extent. Mine is on the Virginia side of the Potomac, near Washington." Concerning this roost a newspaper writer, "Invisible,"[11] tells us, among many highly colored items, that "for an unknown period of time, probably ever since the Potomac valley was settled, if not long before, the woods of 'Cooney,' the old ante-bellum popular term for that part of Alexandria and Fairfax counties bordering on the Potomac, have been occupied by a vast colony of crows. They now roost in the grand old oaks at Arlington. Years ago they occupied a strip of pines that grew back of the river above Georgetown."

Mr. H. W. Henshaw, of Washington, who has known of this roost for about sixteen years, tells me that the crows about Washington come in from the surrounding territory by three main streams, the largest coming from the south, down the river; the next in size from the east, flying over the city, and probably feeding along the shores of the Eastern Branch of the Potomac, and the third, scattering, from the west and southwest in Virginia. During cold or stormy days they do not disperse so widely and stay about on the Potomac flats near the city. Last year there were estimated to be 40,000 or 50,000, but this year probably twice as many. The main colony is of two or three bodies within the

area of a square mile. The roosts are not exactly continuous, but pretty close together, according to the clumps of trees. The fish crows are about one to five in proportion to the common crows.

In Baird, Brewer and Ridgeway[9] is an account of one of these colonies of crows, possibly journeying northward, "from the lips of the late John Cassin, an ornithologist hardly less remarkable for his outdoor observations than for his researches in the closet." On a Sunday morning in April, 1868, when Philadelphia was enveloped in an impenetrable fog, a body of crows numbering hundreds of thousands alighted in Independence Square. "As if aware of their close proximity to danger, the whole assembly was quiet, orderly, and silent. A few birds, evidently acting as leaders, moved noiselessly back and forth through their ranks, as if giving tacit signals." Then scouts departed to explore, and upon their return the leaders again went cautiously through the ranks. But they did not move until another exploring party had made its report, apparently more favorable, then "the whole of this immense congregation rose slowly and silently, preceded by their scouts, and moving off in a westerly direction, were soon lost to view."

The fish crow (*C. ossifragus, Wils.*) is confined to the Atlantic seaboard from Long Island to Florida, and the common crow (*C. americanus, Aud.*) is most numerous east of the Rocky Mountains. W. W. Cooke and Otto Widemann[8] say that the common crow is a resident of St. Louis and vicinity, roosting by thousands in winter among the willows opposite St. Louis.

In a note in the *American Naturalist* for December, 1887, Mr. W. Edgar Taylor[10] signalizes a roost "covering perhaps four or five acres, on Hog-thief Island, in

the Missouri River, about six miles above Peru, Neb." "Two other good sized roosts are known, one ten miles north, and the other on an island eight miles south of Hog-thief Island." Mr. N. S. Goss, author of "Kansas Birds," is quoted as saying that several large roosts exist in Kansas.

Mr. Taylor says the Hog-thief Island roost has been occupied for at least twenty-five years. "The crows assemble about the first of October and disperse about the first of May. About daybreak on a fine morning, when setting out for a day's journey, their chatter and noise may be distinctly heard in Peru, six miles away. The crows in severe winters peck holes in the backs of hogs, in some cases eating off the ears. Sometimes these crows roost in small bushes and large weeds, but generally in trees, often the willow or cottonwood."

In the great region west of the Rocky Mountains we practically leave the haunts of those species of the crow genus heretofore considered, and enter the land of the largest of crows, the American raven (*C. corax sinuatus, Wagl.*). It is interesting to learn from Baird, Brewer and Ridgeway[9] that the ravens form winter colonies much as our eastern species. Dr. Coues is quoted as observing them "congregating in autumn and winter, about Fort Whipple, Arizona." Their roost was in the pines near the small enclosure where the beeves were slaughtered for the garrison, "and the banqueting there was never ended" upon the offal. Also Captain Blakiston observed them near Fort Carlton. They keep together in pairs during the day, but at night roost in one immense body in a clump of aspen trees about a mile from the fort. The incoming and outgoing of the ravens from the roost was with wonderful regularity. They assemble about sunset and disperse about half an hour before sunrise.

Mr. Watase (a Japanese student in this University) tells me that there are vast numbers of crows in Japan, especially in the northern part, where they do immense damage to the crops. In Tokio, in the great forest called the Emperor's Garden, right in the heart of the city there is a colony of many thousand crows which have their nests there, and at dusk from ten miles about they gather at this rookery. Some ten or fifteen years ago a law was passed in Japan that the crows be exterminated. All their nests were torn from the trees and policemen were dispatched in every direction to kill them. Thousands had been destroyed when some thoughtful person suggested that the crows were of great value to the city as scavengers, then the carnage was ordered to be stopped, and to-day, protected by law, they are apparently as numerous as ever. But where the crops suffer from crow depredations, as in the north of the empire, the law giving a bounty of five cents for every crow's head is still in force, and there are men who do nothing but go about killing crows, and indeed make of it a lucrative business. The crows sometimes become so violent that they attack the trains of pack mules which carry fish inland from the seashore. They pick off the flesh from the mules' backs, pluck out their eyes, and at times become very dangerous and violent, so that it is with great difficulty that they are driven off. There are three species in Japan, *Corvus japonicus*, which is distinctly Japanese; *Corvus corax*, which is said to be identical with our own raven; and *Corvus corone*, the common crow of Europe.

The colonies, which are formed only for the winter, come together late in the fall and break up in the spring, following the generally accepted laws of bird migration. In the report of Mr. Jones, of Reedy

Island, in part given above, he says that the crows come from the first of September until it gets cold, and begin to leave by the first of April, until in the last of May none are left. While at St. Louis, Cooke and Widemann[8] say that by March 14th most of the crows have left the winter roost.

The main element bringing them together in a common body at night, I take it, is the social. In the choice of a roost, scarcity of mankind and access to food, combined with a growth of trees available for roosting upon, are the principal points considered. A region once selected is kept for a great many years, if there is no very decided disturbance to cause emigration.

In the following study of the colonies at Arbutus and Avondale, Md., I have attempted to describe the life of the colony during the twenty-four hours of day and night. The facts given are from observations made by the writer during the winters of 1886–87 and 1887–88.

A.—The Arbutus Roost.

Seven miles southwest from Baltimore, a half mile southeast of Arbutus station on the Baltimore and Potomac Railway, is a tract of land of about a half mile square on which are several patches of woods which furnish the roosting ground and its neighborhood for a winter colony of crows. It seems from the testimony of the owners of this land that the crows have roosted there for about twelve years, having previously occupied a piece of woods a half mile or more to the westward, which they abandoned when house-building and wood-cutting by the inhabitants made it undesirable. Although this ground has been for some years the headquarters of the colony, yet it has during that time made temporary changes to

places within a radius of one or two miles. Within this more extended limit, in the memory of "the oldest inhabitant," which individual has lived near Arbutus for over half a century, the crows have come to make their winter colony.

Dr. Godman[4] says "such roosts are known to be thus occupied for years, beyond the memory of individuals; and I know of one or two which the oldest residents in the quarter state to have been known to their grandfathers, and probably had been resorted to by the crows during several ages previous."

There is in the first mentioned half-mile tract one particular piece of woods containing about fifteen acres of ground which seems to be the favorite roosting place of the crows, and from which, according as their numbers increase, they overflow into the surrounding woods and bushes. The trees are mostly of black oak, with some chestnut, white oak, poplar and other common forest species, all of a decidedly "scrubby" growth, not being on an average more than 25 or 30 feet high. The woods are situated in a sort of valley quite surrounded with hills which have been cut into jagged, fantastic forms in the several centuries of digging by the inhabitants for the rather poor iron ore of the region. The dumping of the refuse from these excavations in the hollow or valley has caused huge mounds here and there, and these, together with the well eroded slopes of the small hills, give a decidedly picturesque outlook to the arid land.

The country being of poor soil is sparsely settled, and a glance at a map on which all of the houses are indicated shows in a striking manner that this roost is in a region where are fewer houses than for miles around it. So these persecuted birds over whose heads

the Maryland statutes of outlawry have been hanging for almost two hundred years, would be stupid indeed if they had not learned to avoid man and his gun on every possible occasion, and to seek the most secluded spot available for a roosting place.

The neighboring farmers, with unusual good sense, seem to appreciate the value of the crows, rarely disturbing them, and how far the colony understands this I will of course not attempt to say.

On a bright sunshiny day, up to within about two and one-half or three hours of sundown, the only crows discoverable are the few which remain to feed in this territory, as their allotted ground, when the colony at dawn breaks up for the day. Perhaps in addition some that are blind or sick, too weak to fly far away, have remained at the roost. On a foggy or snowy day, however, more linger about all day, the main body is considerably delayed in dispersion, and the crows come in earlier in the evening. Now, by about three hours before sunset on a clear day, evidently having secured their daily rations, these few fly to above one of the several gathering grounds of the large flocks or detachments of the main body of crows which are to come later. In the course of an hour the few already in are joined by one now and then until quite a number have come together, screaming out their *caws* vociferously and discordantly. This small flock may perchance fly over into the woods a mile to the westward, and by the time it returns in the course of fifteen or twenty minutes will have grown to a very large flock. As it settles down on a near corn field with much fluttering of wings and very successful attempts at making a great noise, its individuals nervously hopping or flying from one spot to

another, one is reminded of a flock of overgrown black birds at the migrating season foraging in some stubble field for food. Suddenly from some common impulse the flock rises and moves away on an excursion for perhaps three or four miles. As the crows rise and start away their noise is, if possible, increased, but gradually dies out as they approach the distant hill, and is quite lost before they disappear to sight on its further slope. When they are gone the wintry field which for an hour has been associated with the noisy birds seems quite desolate.

But now as the sun is becoming large over the western hills we see in almost every direction, singly, in pairs, in small groups, the crows centering toward the roosting ground, and by the time the flock we first observed returns from its excursion it has become decidedly reinforced. Before settling down the flock may again wander off for two miles or more, but so many new individuals are arriving that a number do not join the main body, but seek the tops of the black oaks as if settling for the night. It is about sunset when these first ones alight, and it is not long before twenty or thirty of the nearest trees on the edge of the woods will each have seven or eight black figures perched upon its topmost branches.

Just as the sun is sinking below the horizon the flock which wandered away returns, and so many more crows have joined the force that it has grown to immense proportions. The sunset appears to be the signal for all crows, individually or in flocks, to centre at the roost. They come then in long streams, irregular in outlines perhaps, but rather constant in numbers, and after sunset the incoming is almost without noise, save the sharp whirring of their wings.

Audubon[3] says: "They may be seen proceeding to such places more than an hour before sunset, in long straggling lines and in silence, and are joined by the grackles, starlings and reed birds, while the fish crows retire from the very same parts to the interior of the woods, many miles distant from any shores."

Also Dr. Godman[4] observes that "endless columns pour in from various quarters, and as they arrive pitch upon their accustomed perches, crowding closely together for the benefit of the warmth and the shelter afforded by the thick foliage of the pine. The trees are literally bent by their weight, and the ground is covered for many feet (?) in depth by their dung, which, by its gradual fermentation, must also tend to increase the warmth of the roost."

But among those which have settled upon the perches there is a good deal of *cawing*, which may serve to guide to the roost their fellows belated in the dark or storm. At times, if unusually disturbed, instead of remaining upon the trees they will fly back and forth and high into the air, making considerable noise. Those coming in sometimes answer this signaling, especially if, as I witnessed in the case of a heavy snowstorm in December '87, they may have cause to be confused. As they appear suddenly from out of the distant darkness, or from the thickest of the swirling snow, a spectre procession without beginning and without end, one is haunted by the weird reality of the ghostly scene. We seem to be looking at Poe's "Raven" and all its earthly relations, coming as mysteriously as did that uncanny guest, in a series that shall end "nevermore!"

This body, however, is but one branch of what we must now compare to a vast army of crows. And as

this division is marshaled into camp, from at least two other directions great bodies are coming in streams, settling down upon the trees or flying high above them, outlined against the red after-glow of the sun. The air, as far as one can see toward the west, seems literally alive with crows. It is as if one of those huge swarms of gnats which we are all familiar with in the summer sunshine had been magnified until each individual gnat was as large as a crow, without any diminution in the total number of individuals.

In the winter of '86–'87, as one of a party from Baltimore, I saw one of these vast divisions coming in for the night with singular regularity. It came from the northeast, and as it approached our point of observation was somewhat hidden by a clump of trees, until within a hundred yards of us the procession made a sharp bend and the crows were directly over the woods which constituted the roost. If you will imagine a river one hundred and fifty feet wide and about thirty feet deep, its end a huge cataract by which the water falls to lose itself in a large lake, its beginning farther away than the eye can see, and if instead of water you will make this river of crows not so closely packed but that they can fly easily, and make the swiftness of the current equal to the ordinary flight of the crow, you may gain some idea of the stream which our party watched for over an hour without noticing any diminution in its bulk. And what a lake it made! When a gun was fired the crows rose above the woods like a great black cloud, and when they settled again every available branch of the thousands of trees was utilized to afford them resting places.

Mr. Rhodes[6] says: "The aerial evolutions of this descending multitude, coupled with the surging clamor

of those which have already settled as successive reinforcements appear, and which at a distance greatly resembles the far-away roar of the sea, may justly awaken emotions of sublimity in the spectator."

The crow is ever a wary bird, and even after having perched for the night is easily disturbed. If one walks through the woods where the crows are roosting, the nearest ones rise with the *caw* of alarm and fly over the trees to the farther edge of the main body. If one walks steadily toward them they keep as steadily giving way in orderly wave-like retreat. I have thus followed this colony from copse to copse through the whole neighborhood of its roost. If while walking one but stops, with no other movement, the crows immediately suspicion some treachery and there is a noisy stampede of all within danger. Very probably they have learned that a gunner always halts when about to shoot.

On the morning of February 19th I saw the colony disperse for the day under peculiarly favorable circumstances. The sky was perfectly clear and well lighted by the stars and the moon in its first quarter. We reached the field within 100 yards of the roost about half-past three o'clock in the morning. Because of some noise in walking over the frozen furrows, a few of the nearest crows took alarm at our approach and flew back a few rods into the woods; but this without the slightest noise, save the cracking of some branches or the whirring of their wings in the retreat. For over two hours all at the roost was silent as a graveyard, except that every now and then some restless individual, a sentinel perhaps, would utter a most peculiar croak, just like the louder note of a bull-frog.

But just an hour before sunrise, when the east was

becoming faintly lighted, the crows suddenly commenced awakening, and at the same time commenced cawing. The few who led the measure were within one or two minutes joined by the full chorus of 300,000 or more voices, each apparently striving to be heard by all the rest. Never before had I realized the almost infinite possibility of the crow's variable *caw* in the production of discords. This great noise, which the poetic soul of Audubon conceived to be "*thanksgiving*" and "*consultation*," was kept up for twenty minutes before any movement was discernible. Then about a dozen crows started off for the day's work, followed by more and more, until they were going from the roost much as they return to it in the evening, in the three or more large streams. The crows, however, were much more scattered in the order of flying than in the evening streams. After they had been leaving thus for about twenty minutes, the streams constantly growing larger, a common impulse seemed to move a large number of crows, and they did not wait to "fall in" as individuals, but suddenly joined the stream as a large flock. The streams were thus swollen in bulk quite regularly about every five minutes until the colony had dispersed. In an hour's time, or just at sunrise, the whole body, with the exception of twenty or thirty, evidently too weak to go far off, had left the roost. All this time the din of the general body does not seem to diminish, those left behind apparently doing double duty in the *thanksgiving*, while those going away, as far as one can hear, do not fail to keep up their cawing. In this respect they differ from the evening streams, which in the main come in with but little if any noise. In seeing this morning dispersion I think one is impressed even more than in

the evening with the vast number of crows constituting the colony.

In the daytime the individuals are scattered all over the surrounding country, seeking food in the fields, along the shores of bay, river and creek, one and two together, and then in rather large flocks at the glue factories and stock-yards if there chance to be such rich grounds in the neighborhood. They disperse to a radius of from one to about forty miles over the fields and along the water courses. I have seen them scattered all the way from Baltimore to Philadelphia on the one side and to Washington on the other. Of course these crows were members of two or more colonies.

Mr. Rhodes[6] says that "during winter a radial sweep of one hundred miles, described from the city of Philadelphia and touching the cities of New York, Harrisburg, and Baltimore, will include in the daytime, in its western semicircle, fully two thirds of the crows (*C. americanus*) inhabiting North America, and *at night* an equal proportion in its eastern half." Mr. Rhodes was evidently not familiar with the fact of large numbers of crows wintering in the far South and the West.

That they fly from very long distances is shown by the fact that there are usually a few individuals coming in with the main body who, upon reaching the roosting ground, are so exhausted as to be unable to fly, and can only hop about as best they may to escape their ground enemies. Upon Dec. 17, 1887, were caught two of these crows which, if I may so express it, had the *flyer's cramp*, for in every other respect they were apparently in good condition and are now in sound health. That the muscles of flight had suffered a partial paralysis is shown by the fact that in the

course of a week they had so much recovered that had not their wings been clipped they would probably have flown away.

The successive layers of autumn leaves and excrementa left by the crows in winter have formed a remarkably rich compost for the naturally rather poor soil. Upon a field formerly a part of the woodland which formed this roost, but from which the trees were cut three years ago, much larger crops have been produced than from neighboring fields. Upon this ground many plants new to this part of the country, such as "river weeds," have been noticed by the farmers. In some of the excrements from this roost sent to Dr. Merriam were identified the seeds of the sumach (*Rhus glabra*) and corn, but the seeds of a species of plant much more numerous than either of these could not be identified. Among the small stones, bits of brick and sand and broken shells were found fragments of *Modiola hamatus* and *Arvicola riparius*. Thus it is evident what an important part the crows play in plant, and possibly animal distribution.

In this colony I have identified both the common crow (*Corvus americanus, Aud.*) and the Fish Crow (*Corvus ossifragus, Wils.*). The two species live together very contentedly, although probably in the main seeking different feeding grounds. I believe the common crows are much the more numerous of the two ; but on the wing they are scarcely distinguishable, except by voice, and so the exact proportion of the two kinds is virtually unattainable.

It is an interesting although rather discouraging operation to attempt to separate the variously intoned caws and imagine the condition of mind each one represents. It is a veritable Babel! Old crows, with

a voice like the rasp of a file as it plays on the edge of a saw; middle-aged crows, with long-drawn caws that have andante movements about them, destined to linger in one's ears after the musical apparatus has vanished from sight; and young crows, just learning the difficult art of expressing their emotions, who get along excellently until all of a sudden their note terminates in something totally unexpected, like a boy at the adolescent age, when he is never certain whether he will talk falsetto or base. But in all these different shades of tone there is that one unmistakable nasal basis which so clearly distinguishes the crow's caw from all other bird notes.

C. C. Abbott[5] says: "Crows have twenty-seven distinct cries, calls, or utterances, each readily distinguishable from the other, and each having an unmistakable connection with a certain class of actions; some of which, as for instance the many different notes of the brooding birds, are only heard at certain seasons." Though we may not agree with such an exact classification, yet it is undoubtedly true that crows express quite different states of mind by quite different notes.

A determination of the exact number of crows here collected is not possible, but even the most sober observers place it among the hundreds of thousands. As a basis for an approximate calculation, I have made the following observations at the roost. With the aid of two friends, fifteen different square rods, taken here and there at random, were paced off, and the number of trees thereon capable of furnishing roosting tops counted. An average gave us nine and three-fifths trees per square rod. At any one roosting the crows occupy about ten acres, or ($160 \times 9\frac{3}{5} \times 10$) 15,360 trees. If on each tree fifteen crows roosted—and that, if anything, is not too

large an average—we should have 230,400 crows in the colony.[1] Because of the dim light at sunset, my attempts at taking instantaneous photographs of the incoming streams of crows were failures. A view, however, of one of the gathering flocks, taken about an hour before sunset, as it flew by in a straggling stream, shows two hundred and seventy-three crows in the photographic field. On this basis, the flying time (an average of a number of observations) for the bird to cross the field being fifteen seconds, in three streams coming in for one hour we should have 199,560 crows. But the streams toward the middle and end of the incoming are manifestly much larger than the above, so this number may be taken as a minimum estimate.

Dr. Godman[4] says: "During hard winters many crows perish, and when starved severely, the poor wretches will swallow bits of leather, rope, rags, in short anything that appears to promise the slightest relief." I have often found crows sick of various disorders which I shall not attempt to classify, going blind and starving, and in the aggregate for a winter many suffer the inevitable fate of mortals. I have found as many as eleven sick and recently dead crows upon the roosting ground in one day, and no doubt the hawks and opossums have found as many, for they are so boldly fond of the birds as to become noticeably increased in numbers in the region of the roost in winter, and of their visits well picked bones scattered about bear testimony. But the consumers of crows are not confined to hawks and opossums, for there is an

[1] It is difficult to realize the meaning of such a large number, and perhaps an illustration may help us. It happens that if one crow came in each second, day and night, it would require just 64 hours for this number to assemble.

old colored man in the neighborhood who eats the fresh birds, and when his larder is abundantly supplied, salts down the crows for future use.

Having the total population of the colony and the average death rate we may calculate the average age of the crow. I think that a death rate of five for each night at the roost, drawn as an average from a number of observations, is certainly not too low. Allowing that during the almost equal period the colony is away from the roost the same number die, we then have a daily death rate of ten, or a yearly mortality of 3650 crows. So a colony of 230,400 individuals would be a fraction under 80 years in dying off; or in other words, the potential longevity of the crow would equal about 80 years. It is well known,[1] at least traditionally, that the crow is of remarkably long life, and although, as is easily seen, there are many obstacles in the way of anything but the barest approximation, yet I believe the above calculation is founded upon factors approximately correct.

Through the kindness of Dr. Pattison, of Baltimore, I have been made aware of a roost near Avondale, Carroll County, Md. I visited this colony March 3d, spending half a day at the roost and in the immediate vicinity. The crows here have selected the slope of a high hill upon which is a thick growth of deciduous trees, the oak and the chestnut prevailing. This hill

[1] "This bird sometimes lives for a century or more. Those have been seen in several cities of France which have attained this age, and in all countries and in all times it has passed as very long-lived."—Buffon, *Histoire Naturelle*, Tom. XVIII, 1775, p. 32.

"The raven likewise is reported to live long, sometimes to a hundred years. . . . But the crow, like unto him in most things (except in greatness and voice), lives not altogether so long, and yet is reckoned amongst long livers."—Bacon, quoted in Essay on *Comparative Longevity in Man and the Lower Animals*, Lankester, London, 1870, p. 67.

belongs to a range extending some fifteen or twenty miles from northeast to southwest, parallel to the mountains which, some twenty-five miles away, can be seen from its crest. The exposure of the slope is toward the south, and so the crows in adopting this site are quite protected from the cold northern winds which prevail in winter. There are large tracts of woods adjoining this roost, but only when driven away by shooting do the crows leave this favorite hillside. They have roosted here for about ten years.

The general life of this colony is much as at the Arbutus roost, and I should judge the two colonies to be of about the same size.

Crow Legislation.

The legislation upon crows in Maryland has been quite extensive, the first law for their destruction having been framed in 1704, in connection with one for the destruction of wolves. A part of the section relating to crows is as follows: ". . . Every person that shall bring or cause to be brought to any of the Justices of the peace in any county within this province the head of a Crow with a perfect Bill shall be allowed the sum of six pounds of Tobacco and the Justice of the peace before whom such Crows heads shall be brought shall cause the Bill to be cutt off to prevent the deceit of twice or oftener paying therefore." This law, in 1707, was continued for three years, then revived in 1710. In 1713 a new act was passed putting the squirrels also upon the list of outlawry. This act was continued in force by supplementary acts in 1716 and 1722. In 1728 a new general "act to encourage the destroying of wolves, crows and squirrels" was passed. In it we find that "every

master, mistress, owner of a family, or single taxable, in the several and respective counties within this province" shall be obliged to produce "three squirrel scalps or crows heads for every taxable person they pay levy for that year." The penalty of not producing the required number of scalps or heads was two pounds of tobacco for each one lacking, and for any in excess a like allowance was made. This law was in force for thirty years, when it was repealed, and an act specifying four squirrel scalps or crows' heads was substituted.

Special laws for redeeming heads or scalps in excess of the requirements of these general laws were passed for different and various counties of the State, in 1749, '62 (Baltimore Co.), '94, '95, '96, '98, 1803, '04, '07, '09 and '16. In 1824 all acts heretofore passed for the destruction of crows in the several counties of this State were repealed. Then new special laws were passed in 1826, '29, '30, '31, '46 and '47. In 1860, with the adoption of the first general code of laws for Maryland, Art. 31, concerning crows, was inserted. In it was specified a bounty of 6¼ cents for each crow's head brought in, provided an oath was taken that the crow had been killed in the county where claim was made. In 1864, '78, '80 and '84 (Baltimore Co.), the law was repealed for certain counties. In 1882, '84 and '86 new special laws associating with the crows "hawks and big owls" have been passed.

I have consulted the general statutes now in force of all the States, and find only in one other State, Virginia, that a law concerning the destruction of crows is extant. As early as 1796 a law was there passed requiring for every tithable six crows' heads or squirrels' scalps. In the Code of Virginia for 1873 the right is

given to each county to "allow or discontinue rewards for killing in such counties panthers, wolves, foxes, wild cats, crows or blackbirds."

I have read statements of laws having been passed in the early days of New England, and of such large numbers of crows having been destroyed in one season that, the crops for the next season suffering a like fate from the cut-worms and other insects, the inhabitants by repealing the laws were glad enough to encourage the crows to come back.

The general effect of these laws has been to cause the destruction of large numbers of crows. Dr. Godman[4] has with graphic pen described the methods of hunting and slaughtering them in Maryland in the first years of this century.

It is interesting to learn from Mr. Henshaw that such near relatives of the crow, the blackbirds (*Argelaius gubernator, Wagl.*, and *A. phoeniceus, Linn.*) at San Luis Obispo collect in the fall and winter in immense flocks and roost in the swamps of tulle (a kind of bulrush). They do not come in to the swamp in streams, but in large flocks, and these diving down into the reeds are very soon hidden.

This dwelling together in large flocks is also quite true of the crow blackbird or purple grackle (*Quiscalus quiscula, Linn.*), as we see in this latitude after the breeding season and until migration, and in the South during the winter.

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PARANOIA.

A Study of the Evolution of Systematized Delusions of Grandeur.

From the Clinical Records of Bloomingdale Asylum, New York.

BY WILLIAM NOYES, M. D.

The following case[1] presents several features of especial interest to the student of systematized delusional insanity. The slow beginning, the gradually increasing systematization, and the evolution of a special talent into the most prominent feature of a chronic primary insanity, developing in a constitution showing original unstable mental equilibrium, make it a typical case of Paranoia.

Mr. G., 42 years of age, has been an inmate of the Bloomingdale Asylum since April 30, 1884. He was

[1] This article, under its present title, was prepared for the press and in the hands of the editor of this Journal in March, 1887, but a combination of circumstances has prevented its earlier appearance. At the same time the writer made a translation of an article by Dr. Séglas on *Paranoia*, giving an historical and critical review of the study of mental degenerations and systematized delusions, with a complete bibliography of the literature of systematized insanity. This statement is made here to explain the abruptness with which the discussion on classification at the end of this paper closes, it having been hoped that this article and the translation would appear in the same journal, thus making a continuous contribution to the study of systematized insanity, but this has not been found practicable. Those interested in the discussion of *Paranoia*—a term to which Dr. Spitzka has given the weight of his authority in the edition of his Manual of Insanity in the autumn of 1887—are referred to the article *Paranoia* in the *Journal of Nervous and Mental Disease* for March (*et seq.*), 1888.


LUNA

born in a New England city, of American parents, and his childhood and youth were passed without any special sickness or disease save those common to those periods of life. As a child he showed an unusual fondness for drawing, which was noticed very early by a lady friend of the family of some artistic ability, and she fostered and encouraged his natural inclinations by furnishing him with drawing materials and showing interest in his progress.

He attended the public schools of the city and was considered unusually bright, gaining special distinction in elocution. At 16 he entered the dry-goods business in the capacity of clerk, but became discontented, and after three years came to New York and studied art. For several years he did work for the illustrated weeklies, making comic sketches, illustrating current events, doing lithographic work, and employing himself in similar work without gaining any special advancement. In 1874 he went to Paris and studied art under Gerome, remaining there eight years. His life there was full of vicissitudes, and presented sudden changes from luxurious living to dire poverty. Owing to his bright and witty manners he was much sought after by wealthy young men, and while entertained by them he lived in much luxury, but after their departure he was obliged to exercise the most rigid economy, living, as his father expressed it, "on a herring and cracker a day." His life was also very dissipated as well as subject to hardship and privation. In one of his periods of excess he had an attack of *mania a potu* in which he cut his throat and his left arm. He bled freely and his escape from death was narrow. From that time he has been a total abstainer. An interesting companion, a quick

and ready talker, an excellent story-teller, with flashes of wit and sharp repartee, he presents a typical example of the artistic temperament with its ready susceptibilities, its quick sympathies, and its appreciation of the beautiful. Yet it is the mere sensuous part of the artistic nature that has been cultivated, and no firm purpose or high ideal appears to have governed him; and his whole life has been one of fitful changes and impotent strivings, ending in failure. A good singer and amateur actor, he frequently took part in private theatricals, and at one time thought of going on the stage, and even played a few weeks with a professional company.

He returned to America from Paris and began work again as an illustrator of books and magazines. He opened a studio in this city and gave promise of a brilliant career; but soon after his return his friends noticed a change in his disposition, in a general exaltation of mind and a reckless expenditure of his limited means for odd bits of furniture, swords, and bric-a-brac for the decoration of his studio. Everything that was odd struck his fancy, and he soon came to possess a rich collection of curios. The exaltation increased, and in the summer of 1883 he was troubled with insomnia that continued for several months, but the first positive evidence of mental disturbance came in November, when he began giving away his costly treasures and breaking up his articles of furniture, saying that he had no further use for them. He also shaved his head and mutilated his body as acts of penance. For ten weeks there was a remission, but at no time was he in his normal condition. On the day before his admission to the asylum he was boisterous and ordered the train to be stopped and asked every

one to take a drink. On admission he professed not to remember these actions. The next morning he was elated and demonstrative; said, "It is a fine day, thank God," and on passing through a door, turned around "so as to be on the right side with God." He admitted at one time several weeks later that his actions had been eccentric, but later denied this, and said that he had never been out of his mind, and the world would soon see the great work he was to do. By the end of June he had ceased to "thank God" at the end of every sentence, but stated that he still thought it. A day or two later he became stupid and morose, and being asked the reason, replied "God knows," and would not answer any questions. The second day he became violent, and through the night was noisy at intervals, shouting and jumping up and down in his bed. The third day he talked excitedly and made frequent use of the expression "thank God." From this point this attack gradually subsided. Before the attack he had been reading his Bible diligently, and in a few days he resumed this practice and became silent and absorbed, reading his own thoughts, as he explained later.

Through the summer he remained quiet and was unwilling to converse with his friends, but this condition changed in October, when he showed a desire to converse on religious subjects, and told the supervisor that he expected by constant study to understand every word in the Bible, and that although he had been told that this was an impossibility without a thorough knowledge of the Greek and Hebrew languages, yet by faith and study he hoped to attain the desired result.

He was usually very reticent and would only inti-

mate that he expected to receive some supernatural endowment; stated that he believed the miracles of the Bible and that miracles were performed at the present day.

Early in December, or about a year from the first appearance of his trouble, another period of exaltation came on; he laughed at pathetic passages in plays; quoted from Shakespeare and the Bible, to the annoyance of his fellow patients; spoke roughly to the attendants; joined in the religious exercises at chapel with more than his accustomed fervor; and used the expression "thank God" the same as on admission; and confessed that he could not resist the impulse to sing and shout. At this time there was marked tremor of the facial muscles and his left pupil was larger than the right. He talked in a loud and declamatory manner and showed some personal violence. After two days this attack began to subside, when he said he had been perfectly well, and spoke much of the love of God and his trust that everything would be made clear to the people here some day. This attack was again followed by a period of depression in which he secluded himself, was unwilling to take exercise, and was wakeful at night; and at one time was heard to say that he wished for some one to kill. A period of mild exhilaration followed, in which he spoke much of the beauty of the world being due to the goodness of God, and became annoying by his frequent quotations. His actions became more and more eccentric at this time, but were all due to a consistent following out of his systematized delusions on religious subjects. He would never wear rubbers, giving as a reason that he had never done so, but it is almost certain that his true reason was that he had no right to protect himself from any weather God sends; stormy weather is

part of the divine plan and we ought to submit to it without murmuring. For the same reason he is unwilling to wear gloves even in the coldest weather, saying that his faith keeps him warm and free from disease. If allowed to do so he would keep his window open to its fullest extent even during the coldest weather, because the pure air of heaven is from God, and man therefore cannot be harmed by it. An arrangement of his window so that he can open it but a few inches he looks on as tyranny and a gross abuse of power, but he submits because it is part of his discipline. Early in January, 1885, delusions of persecution developed for the first time, and he complained that some one entered his room at night, and he concealed a billiard cue to attack his supposed visitor. This was accompanied with mental disturbance, and he became declamatory and talked of "God's bright sunlight," to the annoyance of others. About this same time he began to mix dried geranium leaves with his tobacco, so that "by the grace of God he might be benefited by them." He reproached the house-steward for shooting cats, and told him to put a note in the basement where the cats would see it stating that the cats were no longer wanted here, and "if he only had faith of the right sort the cats would no longer trouble him." Soon after this he one day removed a considerable portion of his clothing, tied a red handkerchief about his head and began stamping up and down his room. Being asked the meaning of this conduct, he shouted, "Go and read the second chapter of Genesis and you will see what the Lord says." Bearing in mind his later ideas of the progress of the Holy Spirit from Adam up to Christ, it seems probable that at this time he began his spiritual pilgrimage from the garden of Eden through the various prophets until he shall

finally reach and become part of the Deity. For the next few days he remained constantly in his room, reading his Bible and making grotesque motions or gestures before it in the hope that it might be revealed to him. A month later he stated, in reply to questions, that he considered himself a martyr and most unjustly confined; that he was perfectly well in spite of his queer actions, singing and talking; that he had been slandered, and expected to go down to his grave a persecuted being. He now began picking up bits of string, stones, tinfoil, tobacco, tallow candles, leaves and dirt, jumbling them all together in his pocket. They did not appear to be collected from the mere love of hoarding a mass of trifles, so often shown by the insane, but were saved because everything is of value in this world and nothing should be thrown away, for to pass such things by shows a neglect of God's good gifts to man. To remove these and to take his Bible and fantastic decorations away was to persecute him, but he would not complain and would bear it in silence as it was part of his discipline. Throughout all these gradual changes and evolutions of his fancies into systematized delusions the artistic element always predominated. Burnt matches, pine cones, sticks and stones, were all arranged with his gay-colored handkerchief into odd fantastic shapes that immediately struck the eye on entering his room. In the autumn of 1885 there was a return of his delusions of persecution, and he said that one of the attendants had put an evil eye on him, and that he had seen his physician's eye change from blue to brown. During the succeeding winter he was inclined to expose himself to cold more than ever, and if permitted to do so would stand without clothes in his room on the coldest nights with windows raised to show that his faith kept him warm,

and in the morning would break the ice in his pitcher and take a cold bath.

Regarding man's spiritual nature he said that each person is being continually worked on by different spirits which the normal man is able to hold in check and prevent from getting the upper hand, but when the spirits once get the control, then the individual is completely dominated by them and loses his personality. People complain of heaviness of the head because, as they say, one hemisphere of the brain is not in good condition, but this is all nonsense, for the two hemispheres represent the male and female parts of the individual, and when the head aches there is discord in the household, as in the ordinary troubles between man and wife.

In the summer of 1886 he began a drawing that should illustrate the evolution of the Holy Spirit through the various Biblical personages, beginning with Adam and ending with Christ. This and five others that he drew with slight variation, appear to represent the complete systematization of his delusions and the complete theology that he has evolved through his years of study of the Bible. Mythology is mingled in with the theology, but to his mind it is an integral part of the whole and cannot be separated. His description of the diagram is here given, written in red ink in the original as typifying the redeeming blood of the Saviour.

ARCANA VITAE.

Baptisms.	*Seals.*	*Crosses.*	*Churches of Asia.*
Cain	Germ	St. Andrew	Ephesus
Flood	Zodiac	St. Colomba	Smyrna
Sodoma	Tribes	St. George	Pergamos
Abram	Aceldama	St. Michael	Thyatira
David	Holy Stones	The Prophet	Sardis
Babylon	Prophet	St. Evangeli	Philadelphia
Christ	Sun	Royal Priesthood	Laodicea

EZEKIEL'S VISION BY THE RIVER CHEBOR.

Male			Female	
Right			Left	
Man	Lion		Ox	Eagle
Thought	Might	Cherub	Endurance	Emulation
Abr. to Dav.	Dav. to Bab.		Bab. to X	X to Present

So all the generations from Abraham to David are fourteen generations; and from David until the carrying away into Babylon are fourteen generations; and from the carrying away into Babylon unto Christ are fourteen generations.—St. Matthew 1st, 17th.

PROGRESS OF THE HOLY SPIRIT OF THE CHRIST AS PREFIGURED IN THE OLD TESTAMENT.

Seal of the Germ.—From Adam until the Flood the Holy Seed was sifted through man's nature until it was concentrated in the family of Noah. That which was thoroughly beastly perishing in the Flood. This period marks the first Sealing of the Soul or first step towards the mystical body of Christ.

Seal of the Zodiac.—From the time of Noah's descent from the Ark until Lot's flight from Sodom and God's re-naming of Abram, nature strove with the Holy Spirit in man, and God finally gathered the Holy Seed into the body of Abram, thereby regenerating him, so He re-named him and called him Abraham. Thus transpired the second sealing of the soul.

Seal of the Twelve Tribes of Israel.—From Abraham until the move into Egypt is prefigured the third seal of the soul, when man's self-reliance was broken and his spirit made to seek a force greater than that within himself. Joseph is here made the bright and shining light, the husbandman of all that was great and good.

Seal of Aceldama, or Bloody Seal.—From Joseph through years of cruel servitude and oppression, until the birth of Moses, again rolled the seed through man, winnowing itself and gathering force to be gathered in the bosom of Moses, the coming leader of the people of Israel and servant of God. So God has typified the fourth sealing of the soul.

Seal of the Holy Stones.—From the birth of Moses until the crossing of the Red Sea and the destruction of the Egyptian host, passes the fifth sealing of the seed and sealing of the soul, God leading his people from their religious rites and superstitious observances in Egypt, and preparing them for a higher, holier religion.

Seal of the Prophet.—From the Red Sea to the promised land occurs the sixth sealing of the soul. Here was given the law of boundaries and limitations, and the soul was turned back upon itself and forced to prove the sincerity of its faith and beliefs.

Seal of the Sun.—From the promised land until the coming of John the Baptist and Jesus Christ, passes a period which marks the seventh sealing in the existence of the soul. During this period arose many prophets who were the spiritual fathers in Christ to the people, preparing gradually for the final development of the perfect Christ, the Redeemer of all mankind, God's regent upon earth.

The soul must pass through all these stages of purification before it can enter the Christ, after which it passes into the priesthood of Melchizedek.

Unfortunately, the particular chart on which he illustrated this Progress of the Holy Spirit was destroyed. He made twelve of these charts altogether, one for each of the tribes of Israel, but he tore up all but four, three of which were happily given away, so that he has one only in his possession now. During the summer and autumn of 1886 he worked several months on these charts, elaborating them with the greatest care. They were all colored in the most delicate manner with water colors, and the delicate shadings make it extremely hard to give in black and white an adequate idea of the beauty of the design. Two of these charts are here given, being reproduced from photographs. He has made no such elaborate description of these as of the first one, but the design with the dove in the centre corresponds with some closeness to the one whose description has been given. In the centre is the dove representing the Holy Spirit, and surrounding it are the different crosses given in the *Arcana Vitae*, and a close study will show the seven crosses, most ingeniously worked together. It is probable that in looking at the design closely for the first time one will suddenly see a new cross take shape before his eyes, and this indeed is what the patient says occurs with him. In describing the crosses he will say, for example, that in drawing the cross of St. Andrew the lines suddenly took a new shape and he found he had also made a cross of St. Michael. This to him is a matter of deep significance, and he feels that his work is directly controlled by a higher power, and that the work of his fancy is really inspired.

Outside these central crosses are the names of three ancient deities who were each characterized by some special attribute, and under these the parts of the

body that Mr. G. conceives these deities especially to have represented, and then comes the name of the Biblical personage in whom these elements were finally exemplified and embodied. To the left of the dove is Venus, representing Blood, exemplified in Moses; above is Osiris, representing Flesh, embodied in Adam; and to the right Psyche, representing Water, typified in Noah. These three are but the gross and material parts of Man, representing indeed necessary steps in his progress through life, but secondary and subordinate to the higher part of his nature represented by Truth and the Spirit,—which received their ultimate embodiment in *Christ*.

The Lion, denoting Might, and Eagle, signifying Emulation, are the same in this design as in the first, but it is uncertain just what symbolism is connected with the serpent twining about the cross, and the open book crossed by a sword and pen, unless indeed this last may mean the Bible with the emblems of peace and war lying quietly within it, and it seems not unlikely that the serpent is emblematic of the Betrayal. For the rest of the design, however, we need make no inferences, as it corresponds closely with his description.

Outside of the circle enclosing the crosses are the seals, sealing the Holy Spirit. In the large light triangles, or rather rays of the sun, are given the names of the twelve apostles, forming the SEAL OF THE PROPHET. Above these, in the same space, are the signs of the zodiac in the extreme points of the triangle, with the names of the parts of the body underneath that these signs correspond to in the ancient mythology; this forms the SEAL OF THE ZODIAC. Between these large light colored triangles are the

twelve holy stones, represented as ovals, and with their names plainly distinguished in the cut, making the SEAL OF THE HOLY STONES. In the small triangles directly above the Holy Stones are given the names of the twelve tribes of Israel, but the color of these in the chart (vermilion) is such that the lettering does not come out in the photographic negative. This gives the SEAL OF THE TWELVE TRIBES. Directly beneath the Holy Stones, filling in the space between the bottom of each large triangle, is the SEAL OF THE GERM, colored dark green, and running down on each side of the top of these large triangles are small triangles, colored dark red and forming the SEAL OF THE ACELDAMA or BLOODY SEAL. On the circumference are the names of the constellations of the zodiac and directly under these the names of the corresponding months of the year, and under these again are the mythological representations of the constellations, Leo (July) being at the top, and then in order to the right come Virgo (August), Libra (September), Scorpio (October), Sagittarius (November), Capricornus (December), Aquarius (January), Pisces (February), Aries (March), Taurus (April), Gemini (May), Cancer (June). This gives the last sealing of the Seed, the SEAL OF THE SUN.

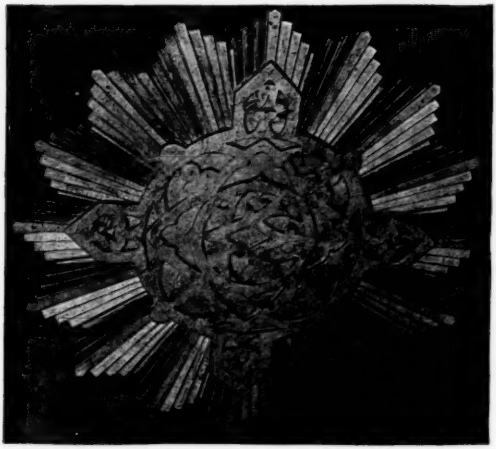
It will be seen that beginning at the circumference at any point and going toward the centre there is a complete astronomical representation of the season of the year, first the name of the constellation, then in succession the month, the constellation depicted pictorially, the sign of the zodiac and the part of the human body corresponding in the old astronomy to this sign of the zodiac.

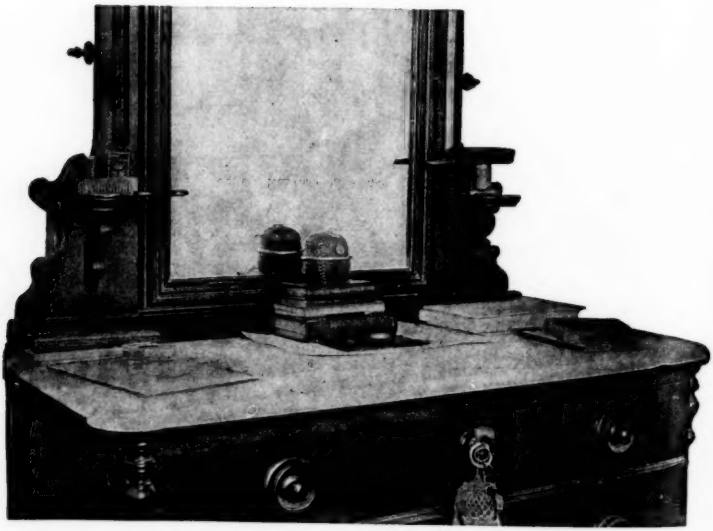
The second chart is by no means so elaborate as the first. In the centre is a representation of St. George

slaying the dragon, and surrounding this, beginning at the left, are inscribed the legends *Faith*, *Hope*, *Charity*, *Love*. Here again the colors in the original are such that the lettering does not come out well in the photographic negative.

After finishing these symbolic religious charts, Mr. G. had a long period of inactivity, giving up painting and drawing completely, and spending much time in reading the Bible. During these inactive periods he lies down a great deal of the time, lying flat on his back and looking upward; and he often has a cane or some small article in his hand that he twirls or tosses. This inactive period lasted for several months, when he again took up his artistic work, this time modeling in wax. After making several small designs he began and completed two large representations of *Comedy* and *Tragedy*, illustrations of which are given from photographs of the plaster casts given to the writer. His passion for the odd and fantastic is here again well exemplified.

An excellent conception of his mental twist can be obtained from a description of his room, for here his fancy has been given full play and he has been permitted to decorate this as he chose. Over the inside of the door hangs a curtain on which are stitched various designs cut out of red cloth. The curtain is made of three pieces of gray, yellow and red flannel, and in the centre is the word CHARITY, with a sword piercing it through the centre. Below this is Fortune's wheel, and under this three turtles. On the upper third is a dragon, with a full moon in the left hand corner, and the designer's initials woven fantastically together. A bat with outstretched wings is on either side of the centre design.





Behind this curtain several months ago, but since taken down, he had placed a horse-shoe to which was attached a small chain, through which passed a piece of bamboo on one end of which was a piece of castor and on the other several bits of wire. These, as is the case with everything he thus puts up, all had some symbolic meaning, but he took offense if they were ever alluded to.

On the outside of the door is tacked up a circle cut from thin wood with a scroll saw. At the four quadrants of this the circumference is broken by the projection of a portion of the wood in such a way that the four together form the ends of a Greek cross; but instead of the cross being continued through the circle, the interior of this is taken up with an elaborate design, delicately sawed out, in which is woven the letters A and ω, alpha and omega. The design is brought out clearly by being placed over red paper, and a little red paper triangle is placed at each end of the cross, thus forming a cross of a different kind.

On the head-board of the bedstead he has placed a circle carved out of soft wood and with the rays gilded to represent the sun; and in the centre of this in a somewhat intricate design are the symbols A and ω again, alpha and omega. This emblematic sun comes directly above his head when lying down. (In photographing this the camera had to be placed at the side so that the circle is distorted.)

His bureau is always arranged with the most scrupulous exactness, every article having its particular place. When the photograph of the bureau was taken there were not so many trifles on it as there have been at other times, but the illustration shows well the systematic order in which everything is placed, and

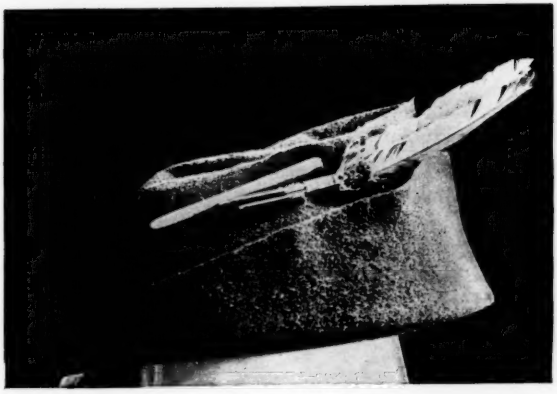
on this occasion no special arrangement had been made, but it was in its usual condition.

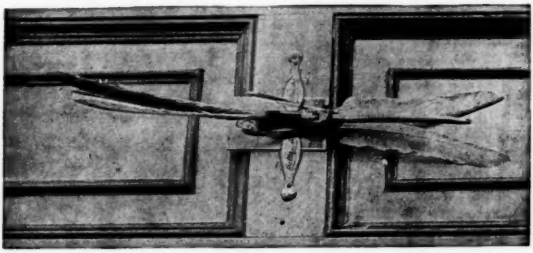
While in his room he wears a green soft felt hat decorated with a feather and his modeling stick, and on leaving his room this is always placed over his water pitcher as shown in the cut. There are much fewer articles on the hat now than in the summer of 1886, when he had covered the hat with the following articles: two steel watch chains, nine buttons, a child's toy tin spoon and plate, part of a suspender buckle, two brass covers to cachou boxes, one ladies' rubber hair pin, one necktie clasp, two brass labels from a fruit jar; the point of the hat was surrounded with a large steel ring, and the edge was turned up at the back and tacked to the hat with a fancy Japanese button. The green ball on the bureau, over which the steel ring is placed, was formerly in the crown of the hat.

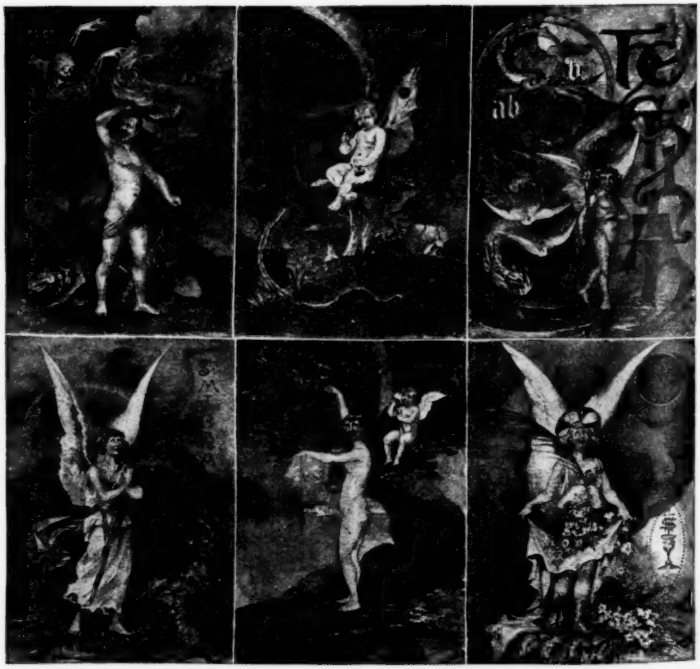
At this time he was wearing a pair of sandals (originally suggested for surgical reasons), and he never left his room without placing these sandals in his room and standing his clothes brush on them at a certain angle.

The light felt hat shown in the cut he has at present discarded, wearing only the green one; the decorations on this light hat approach somewhat those formerly on the green one.

On the window casing he has fastened some feathers, a tooth-brush handle, one of his modeling sticks and a rubber hair pin, all secured together by a pair of confectioner's tongs. Any disturbance of the articles in his room, or any comment on them, greatly distresses him and he gives an abrupt answer and turns the subject, and with the exception of the medical







staff and the attendant who cares for the room, no one enters it.

The fall and winter of 1887–88 were marked by no artistic efforts on his part, but during the spring he took up his painting and carving and now (April 1888) he does some work each day. He has just finished a series of 12 water color sketches, and seven of these are here given to show in some degree his high artistic ability. Of the six represented in one group, the one in the upper left hand corner is THE WOLF SLAYER, then comes PUCK, then SHECHINAH or THE LIGHT OF LOVE, Shechinah meaning to the Jews that miraculous light or visible glory which was a symbol of a divine presence. In the circle in which the *S* is elaborately drawn is also the word *Abba, Father*. Of the three lower ones the one at the left is ST. MICHAEL, the next ONE OF THE FATES, and the last the angel SANDALPHON, with the Holy Grail at the side, and the letters Alpha and Omega at the top (the design must be inverted to make out the Omega.)

The coloring on all of these is delicate and harmonious, but none of them equal in grace the picture of LUNA; the background of this is a delicate blue, and the effect of the light and graceful floating figure is very striking. This was the last of the series of twelve to be finished and the one that he takes most pride in.

While working on these sketches he made at the same time the design for a book-plate, representing Cupid learning the alphabet, and the entire design, he says, is full of symbolism—a favorite word. Cupid has his finger on *Alpha*, signifying the beginning of his education; above the book is Cupid's target with a heart for the centre, that he has pierced with an arrow, while the full quiver stands to the right. The

curious fish under the *Veritas* represents the ΙΧΘΥΣ of the early Christians, while three crosses symbolic of the Christian religion are in the upper left hand corner, brought out by heavy shading of the cross lines. On the book of knowledge is perched the dove, emblematic of purity, while the olive branch at the left of the book and the palm under the Fool's Bauble give still other religious symbols. The lamp of knowledge is burning brightly in front of Cupid, while at his feet are the square, compass, triangle and pencils, symbolizing the designer's profession.

In appearance he is of medium height, well formed and muscular; light hair, which he keeps cut close to his head; and light moustache; his head is short and round, with but little occipital protuberance. The most striking peculiarity is the decided asymmetry of the face that is noticeable at first glance. The right eye and eye-brow are higher than the left, and also the right side of the mouth, and when he laughs this is especially noticeable. The nose, which is well formed and large, deviates slightly to the left. The left ear is smaller than the right and lies close to the head, while the right turns outwards. The whole right side of the head appears larger than the left, and this is

shown by the accompanying map of his skull taken by a hatter. There is a wide range of normal variations in skulls, but in the present instance it seems not unfair to connect this with the other evidences of asymmetry. In walking his head is invariably tipped toward the left shoulder, and in addition his hat is tipped still further to the left, so that the one-sided appearance is very noticeable. Besides these peculiarities he carries his left hand in his trousers pocket in summer and in his overcoat pocket in winter, while he swings his right arm vigorously to and fro. It should be said, however, that when he had *mania a potu* in Paris he cut his left hand badly, and in consequence the fingers of that hand are somewhat contracted and the circulation is poorer than in the other, which may account in part, if not wholly, for his habit with respect to carrying it.

His mental condition at present is one of mild exaltation. He whistles and sings some, but not enough to cause annoyance. For a time he discontinued work on the drawings of the *Arcana Vitae* and began carving some designs on the outside of a wooden chopping-bowl. On two sides appears the sign I H S woven together into a monogram and surrounded by rays representing the sun; and in another place A M for Alma Mater and Alpha and Omega, the M being reversed into W. Other symbolical designs are drawn on the sides of the bowl, and he spent several hours each day carving. His present work is the carving of another wooden bowl, with a lion's head in the centre and the legend *Pro rege in tyrannos* surrounding this, with elaborate tracery designs on the sides. He is perfectly willing to stay in the institution because this is part of his discipline and he must take the good

and bad alike. Insanity is only a relative term, he says, and every one has to pass through a condition in which they are what is commonly called insane, but it is all for their own good and they must not question the designs of Providence. When the time comes for him to go out he will go, he says, and until then is perfectly willing to remain. To the ordinary observer he appears to be a bright, intellignt man; somewhat given to oddities of dress to be sure, but without the striking peculiarities of speech and manner that the laity expect in a case of mental disease. There is but little mental enfeeblement, and none that would be noticed in an ordinary conversation, but he is unable to apply himself continuously, and months at a time may go by without his lifting a pencil or brush. He is bright and interesting in conversation, and a capital mimic. He recognizes the delusions of other patients and often tells of them with much enjoyment.

A few words only need be said as to the place the case should occupy in any scheme of classification of mental diseases. The slow and progressive course, the original mental twist in the direction of the odd and fantastic in art, the cranial anomalies, the evolution of systematized delusions, and the periods of delirious grandeur followed by morbid depression, make it a typical case of *Primäre Verrücktheit* of the German authors, or of *Paranoia* of the Italian and French school; or of the *Monomania, Primary Monomania,* or *Primary Insanity* of the American and English writers. Of all these terms that of *Paranoia* is much to be preferred, and it is hoped that this word may find a definite place in the classification of mental diseases.


GOOD GOD·
GOOD DAY·
VERITAS
GOOD - NIGHT·
GOOD MORROW·

SOME EFFECTS OF STIMULATING GANGLION CELLS.

Preliminary Communication.

C. F. HODGE.

The aim of this series of experiments has been to ascertain to what extent changes due to the functional activity of the nerve cell can be seen by aid of the microscope. The work is based on the fundamental idea in all cell activity, viz. that in the resting state the cell elaborates highly complex compounds, and that these break down to yield the energy by which the cell does its work. These processes have been studied and successfully demonstrated by others in certain gland cells. We applied similar methods to their study in nerve cells; thinking it would be strange if they should prove undemonstrable in cells so large, so definitely characterized, and which stand in so vital a relation to the energy of the animal body.

For this purpose we have used the posterior root ganglia. Fifteen experiments were made on frogs. One, the last experiment, was made on a cat.

The preliminary question as to the minute structure of the ganglion demanded attention at the outset. Mr. Nelson, working under the direction of Dr. Birge at the University of Wisconsin, counted the fibres in the

posterior root and the cells of the corresponding ganglion of the frog, expecting to find, as Birge had found for the anterior root and motor cells, one cell for each fibre. He counted about ten ganglia and, allowing 2 to 4 per cent for error in counting, found *two* nerve cells to the fibre. This would indicate a more complex structure of the ganglion than Ranvier supposed. To study this point we teased the ganglia, using a fine jet of water instead of needles, and obtained preparations which we think demonstrate the following points:

1. Typical bipolar cells do occur, two having been found.

2. The axis cylinder of the process is often seen to divide and enter the cell as a spiral and a straight fibre.

3. At the angles of the "T" the axis cylinder of the cell process may be seen to divide and pass both ways in the nerve fibre, of which it *seldom* forms the *whole* of the axis cylinder.

4. Two cells, in a number of cases, have been found to unite their processes, not necessarily as a cell junction, but to aid in making up the axis cylinder of the same nerve fibre.

If two cells are connected with a fibre in this way, we see no reason why more may not be. So that we may conclude, whatever the number of cells in the ganglion, that our stimulus applied to the nerve trunk will reach them all. They probably function as bipolar cells.

Stimulation Experiments.

Results of these may be briefly summarized.

Four experiments, on frogs, in which curare was used, gave no decisive results.

Five experiments, in which the circulation was disturbed, *i. e.* where the frogs were bled or the capsules

of the ganglia torn off with a view to prevent rejuvenation of the cells, gave unsatisfactory results. See Table I.

Before referring to the tables it should be stated that several observers arrived independently at the conclusion that the nuclei of the stimulated cells looked smaller than those of the unstimulated. This led to the series of measurements given in the subjoined tables. The nuclei were measured, long and short diameters, in sets of one hundred each; fifty stimulated and fifty unstimulated being taken from as nearly corresponding sections of the two ganglia as possible. The measurements were made to the nearest μ under a magnifying power of Leitz Oc. 3, Obj. 7. (= 600 diameters). The diameters were put down in series, then averaged, and this average is given in the tables.

TABLE I.

Frog No. 8. Bled. Stimulated 7 hours; five minutes of stimulation alternating with five minutes of rest.

One set of 100 nuclei. Ganglia hardened in corrosive sublimate.

AVERAGE DIAMETERS IN μ.

	Long.	Short.	Mean.
Resting.....	14.41	10.09	12.25
Stimulated	13.80	10.21	12.00

Staining, structure of protoplasm, etc., not distinguishable.

One experiment, in which the ganglia were suspended in normal salt solution while being stimulated, gave very fair results.

TABLE II (Condensed).

Frog No. 14. Ganglia stimulated, while suspended in normal salt solution, 3½ hours, five stimuli per second, one minute of stimulation alternating with one minute of rest.

Two sets of 100 nuclei each.

9th pair of ganglia, hardened in corrosive sublimate.

	Average Diameters. Mean.	*Remarks.*
Resting	15.06	1st set. Measured by myself *previous* to Mr. W.'s measurement of 2d set.
Stimulated	13.62	
Diff.	1.44	
Resting	14.34	2d set. Measured by Mr. W. *without knowledge of my results*, and having but one of the ganglia in field at the same time, and *not knowing which had been stimulated* and which not.
Stimulated	12.12	
Diff.	2.22	

Set 1 and 2.

Resting	14.70
Stimulated	12.87
Diff.	1.83

Treating the nuclei as spheres, and computing the volumes from the mean diameters, we have per cent of shrinkage in bulk of nucleus (resting, 100 per cent; stimulated, 67 per cent) 33 per cent.

Differences in staining and appearance of protoplasm not clearly in agreement with those found in frog No. 7 and cat. Treated by Gaule's quadruple staining method, the stimulated cells stained somewhat redder with eosin than the unstimulated. (See remark on staining under Tables III and V.)

The best results were obtained from experiments in which the circulation was kept most normal (see Tables III and V). Table IV gives only a fair showing for frog No. 15, the experiment being not altogether successful.

TABLE III.

Frog No. 7. Made reflex. Stimulated 2½ hours, intervals of rest and stimulation being two minutes.

Three sets of 100 nuclei each. In set 1 the cells were also measured.

		Nuclei. Average of 50 Diameters.			Cells. Diameters.
		Long.	Short.	Mean.	Mean.
2d pair ganglia. 9th pair ganglia. 8th pair ganglia. Hardened in corrosive sublimate.	Resting.....	16.09	12.50	14.29 1st set.	39.69
	Stimulated ..	13.62	11.47	12.54	35.00
	Resting.....	15.97	12.08	14.03 2d set.	
	Stimulated ..	14.81	10.44	12.62	
	Resting.....	15.78	11.47	13.62 3d set.	
	Stimulated ..	14.25	10.53	12.39	
	Resting.....	15.94	12.02	13.98 Sets 1, 2 and 3.	
	Stimulated ..	14.22	10.81	12.51	

Per cent shrinkage in volume of nucleus, computed as above, 33 per cent (resting, 100 per cent; stimulated, 67 per cent).

It was in this series that the nuclei first appeared shrunken in the stimulated cells.

Staining somewhat lighter in stimulated cells, due to—

1. Protoplasm of stimulated cells less densely and coarsely granular and much vacuolated.

2. Nuclei more distinct in stimulated than in unstimulated cells.

TABLE IV.

Frog No. 15. Cerebrum removed and wound allowed to heal before the experiment. Stimulated 5½ hours at a temperature of + 35° C., intervals of stimulation and rest being one minute.

Three sets of 100 nuclei each.

	Diameters. Mean.		*Remarks.*
Ganglia of 2d pair, hardened in picric acid.	Resting.....16.94	1st set.	*Set* 1 was measured by myself previous to measurement of second set.
	Stimulated ..16.00		
	Diff. .94		
	Resting.....16.81	2d set.	*Set* 2 was measured by Mr. L. without *any knowledge* as to my own previous measurement and with *no knowledge as to which of the ganglia had been stimulated.*
	Stimulated ..15.47		
	Diff. 1.34		
9th ganglia. Flemming.	Resting.....20.74	3d set.	It will be noted that both Mr. L.'s and Mr. W.'s measurements (Table II) make the difference between stimulated and unstimulated nuclei somewhat greater than my own.
	Stimulated ..19.53		
	Diff. 1.21		
	Resting.....18.16	Sets 1, 2 and 3.	
	Stimulated ..17.00		
	Diff. 1.16		

Volume shrinkage 19 %.

Resting....100 %
Stimulated 81 %

Staining and structure of protoplasm not well defined; probably due to the fact that the frog died toward close of experiment. At its close the muscles were beginning to pass into rigor mortis. Stimuli used excessively strong.

TABLE V.

Cat No. 1. Optic thalami punctured. Stimulated, one minute of stimulation alternating with one minute of rest, for 7 hours.

Two sets of 100 cells and nuclei each.

1st set.	NUCLEI.				CELLS.
	Diameters in mm.				Diameters.
	Long.	Short.	Mean.	Shrinkage.	Mean.
1st dorsal, hardened with osmic acid. Resting....	18.16	14.75	16.45	100%	59.06
Stimulated..	15.84	12.44	14.14	62%	57.19
			Diff. 2.31	38%	

2d set.	Nuclei. Diameters in mm. Long.	Short.	Mean.	Shrinkage.	Cells. Diameters. Mean.
7th cervical, hardened with Flemming. Resting	17.34	15.53	16.44	100%	57.50
Stimulated	16.28	14.37	15.32	80%	56.25
			Diff. 1.12	20%	

Sets 1 and 2.

Resting	16.44	100%
Stimulated	14.73	71%
Diff.	1.61	29%

The difference between sets 1 and 2 may be due in part to the different hardening agents used. It is probably due in part also to the position of the nerves between the electrodes; the nerve from the 1st dorsal coming first in the circuit, that of the 7th cervical third.

Staining, in general, lighter in the stimulated ganglion.

The experiment on the cat was the most satisfactory of all, both as to operation and results. As anaesthetics are a disturbing factor, the optic thalami were punctured during slight anaesthesia from *ether*. The pulse and respiration remained normal during the whole experiment. The right brachial plexus was laid bare in the axilla and stimulated, one minute of stimulation alternating with an equal time of rest, for seven hours. The cells of the stimulated ganglion show extreme vacuolation, whereas scarcely any is observable in the unstimulated. The nuclei, besides being smaller, are more irregular in outline in the stimulated than in the resting cells. It was noted independently by three observers that the nuclei of the capsule were shrunken in the stimulated cells.

The principal results thus far may be summarized as follows:

1. The nucleus and cell body both decrease in size as a result of stimulation.

2. The protoplasm of the cell becomes vacuolated as a result of stimulation.

3. Differences appear in staining.

These experiments have been made under the guidance of Dr. H. H. Donaldson, Associate in Psychology in the Johns Hopkins University.

BALTIMORE, April 26, 1888.

PSYCHOLOGICAL LITERATURE.

I.—HISTOLOGY OF THE NERVOUS SYSTEM.

The Structure and Combination of the Histological Elements of the Central Nervous System. FRIDTJOF NANSEN. Bergens Museums Aarsberetning for 1886.

This paper of nearly two hundred pages is in English and contains the author's views of the minute structure of nerve cells and fibres, chiefly in invertebrates. There are eleven plates. From the study of species of mollusks, Chaetopodes, Oligochaetes, Crustaceans, Ascidians, and the two low vertebrates, Amphioxus and Myxine, he states the following: All nerve fibres, or nerve tubes, as Nansen prefers to call them, contain one or more primitive tubules. Under certain circumstances these nerve fibres have been described as containing fibrillae floating in a liquid contained by the sheath of the fibre. The author rejects this view and presents his evidence for one which differs from it. According to the view given, the nerve fibre is a tube. The subdivisions within the fibre are the "primitive tubules," and these contain the "hyaloplasm" which is the true nervous substance. The primitive tubules are the meshes in a supporting substance designated as "spongioplasm," a substance described as similar to the neuroglia which forms the sheath of the nerve tube or fibre. We have then within the nerve tube the primitive tubules, the wall of each tubule being formed by this spongioplasm.

In the study of the cell, Nansen finds that one principal constituent of the protoplasm of the cell is the primitive tubules, which have there the same structure that they have in the nerve tubes. The course of these primitive tubules within the cell is but partially made out, but they can be seen at times to run in circles about the nucleus, and thus give to the cell the concentrically striated appearance which has often been described. Beside this there is a spongioplasmic reticulation in the cell body, so that the hyaloplasm filling these reticulations and that in the primitive tubules go to make up the protoplasm of the cell.

Regarding the nature of the cell processes, Nansen follows Golgi in every particular. All the processes save one are protoplasmic, and these have probably a nutritive function. The remaining prolongation, the axis cylinder process, is always branched and belongs to one of two types: that where the identity of the axis cylinder is almost at once lost by profuse branching, or that in which it gives off branches but at the same time maintains its identity and passes to the periphery.

The author next proceeds to the examination of the dotted substance of Leydig. He concludes that it is formed of tubes and fibrillae which do not anastomose with each other, but form a close web or plaiting. The term fibrillae is used in this case to designate very fine

primitive tubules and also fine prolongations of neuroglia substance. The meshes of the dotted substance, as described by other authors, are only the transsected sheaths of the tubules, and the inter-fibrillar substance is hyaloplasm, the true nervous substance filling the tubes.

Lastly the author gives a scheme for the course of an impulse in a reflex action. The impulse starting from the periphery passes by the cell on the posterior root ganglion, and enters one of the branches into which the sensory fibre divides in the cord. These branches of the entering fibre are assumed to be in connection with at least the branches from the two sorts of cells which, according to Golgi's classification, are there present. Nansen gives reasons for thinking that the impulse does not enter the sensory cell of Golgi. The entering branches being, however, connected with the branches of the motor cells, it is assumed that the impulse travels from the sensory network through the lateral branches of the axis cylinder prolongation of the motor cells. At this point two courses are again open to it. It may either pass up into the motor cell or out along the prolongation. Nansen thinks that the latter course may be the one taken. As is plain, this view relieves the cells from any direct connection with such an impulse. The role suggested for the cells thus thrown out of employment is that of nutritive centres.

The investigation represents much careful study, as far as the histology is concerned, though the presentation could have been condensed with advantage. Against the speculations at the end of the paper there is certainly some positive evidence from the peculiar irritability of nerve cells as compared with that of other elements of the nerve centres. On the other hand, the hypothesis needs for its support either the assumption that the tubules or fibrillae form T branches in the neighborhood of the cell, or else that the conduction in the fibrillae or tubules is not isolated; and so far as known, there are no histological facts which favor either of these assumptions.

Das zentrale Nervensystem der Acephalen. B. Rawitz. Jenaische Zeitschr. für Naturwissenschaft, B. 20 (N. F. B. XIII), H. 2 und 3, 1887, pp. 385–460. 21 Tafeln.

The author studies the nervous system in the Acephala with the main view of getting a better means for classification within the group. The result of his investigation is to place the Ostreacea at the head of the group because of the highly differentiated visceral ganglion which it possesses. On the way the paper touches many points in comparative neurology. Regarding the form of the ganglion cells, R. is a vigorous supporter of the unipolar cells. The connection of this cell with others may be considered to take place through the network into which the single nervous prolongation is considered to break up. Other cells are described which have only protoplasmic prolongations. Cells are figured as uniting with one another by these latter.

The principal prolongation, where it exists, is considered as the homologue of the axis cylinder or Deiters prolongation, and is described as passing toward the centre of the ganglion. In a few cases the prolongation passes on to a nerve, but in the majority it breaks up into a network in the centre of the ganglion, and from this network the fibres arise. The fibres are simply groups of axis cylinders separated by a homogeneous medium and enclosed in a connective tissue sheath. A ganglion consists of several layers of cells surrounding a

central medullary substance. Both cells and central substance contain something resembling myeline. This myeline separates the fine varicose fibres which make up the truly nervous part of the central substance. This latter is considered as the homologue of the white matter in the vertebrates. No structure is found which corresponds with the neuroglia of the vertebrates.

There is a detailed account of the course of the fibres in the ganglia in different forms, and also several generalizations as to the function of cells from their form and arrangement. The reviewer finds the evidence inconclusive on many of the points stated above.

Zur Anatomie des Nervensystems der Gymnophionen. J. WALDSCHMIDT. Jena. Zeitschr. für Naturwissenschaft, Bd. XX, S. 461.

Under Wiedersheim's direction the author has made a study of the brain and cranial nerves in this interesting order of the amphibia, the representatives of which have rudimentary sense organs and no limbs. The olfactory division of the fore-brain is well developed, the cerebral hemispheres not remarkable, the inter-brain very poorly developed, the mid-brain undivided, the hind-brain wanting, and the after-brain moderate. The pineal gland is very rudimentary. Of the cranial nerves down to the tenth, the second is rudimentary, corresponding with the very poorly developed eyes; the fourth and sixth cannot be found, and the eighth, if represented at all, is only present as the merest rudiment, corresponding with the absence of any auditory mechanism. The chief interest centres in the first pair. There are two roots from each olfactory lobe, a ventral and dorsal. The former is best developed. In the opinion of W. the ventral represents the pair usually found in the vertebrates, while the dorsal roots have been secondarily acquired by this order, which is practically reduced to this single special sense of smell. The condition of the parietal eye as indicated by the very rudimentary state of the pineal gland and the absence of any parietal foramen, is also a point of interest.

Do the Nervi Erigentes leave the Spinal Cord in Anterior or Posterior Roots? GASKELL. Proceed. of the Physiological Society, 1887, No. 1, p. 4. The Journal of Physiol. VIII, 1.

Opinion on this point has been divided. The author stimulated the peripheral portions of the sacral nerve roots in six rabbits. The anterior roots of the second and third sacral nerves caused an erection when stimulated. The stimulation of the posterior roots produced no effect. The inference drawn is that vaso-dilator fibres are to be looked for in the anterior nerve roots.

Zur Anatomie des Froschgehirns. M. KOEPPEN. Neurolog. Centralbl. No. 1, 1888.

In Schwalbe's laboratory and under his direction the author has studied the normal anatomy of the frog's brain by Weigert's haematoxylin method and carmine staining. In the preliminary account here presented the principal results are summarized. The vagus, trigeminus, and acusticus all have large ascending roots, which in the case of the vagus and trigeminus are double. The main ascending root for the vagus is in the lateral column, almost the entire column being used in this way, while for the trigeminus it lies in

the dorsal column; the minor ascending root for these two nerves is found in the dorsal cornua. The acusticus has a three-fold origin, (1) general nuclear mass at that level; (2) from large cells which are the representative of the nucleus of Deiters; (3) from a round nucleus in the dorsal part of the gray matter. The large cells stand in connection with the roots of the acusticus on the one hand, the root fibres being large, and on the other appear to connect with the largest fibres in the cord, these latter running in the ventral columns and entering the ventral nerve roots. This is supposed to represent part of the mechanism for the equilibrium centre. Fibres lying in much the same position as Mauthner's fibres in the fish are found and homologized with the posterior longitudinal bundle. There are no uninterrupted tracts to the fore-brain, and there is nothing corresponding to a pyramidal tract. There is a well developed ventral commissure, an inferior olive, and the system of fibres in the fore-brain is complicated, but the individual fibres are not brought out by haematoxylin. K. confirms the existence of a corpus callosum. The olfactory nerves start from masses of fibres in the glomeruli, there being no cells in these glomeruli, and the olfactory nerves are partially crossed.

Ueber die hinteren Nervenwurzeln, ihre Endigung in der grauen Substanz des Rückenmarkes und ihre centrale Fortsetzung im Letzteren. Bechterew. His. und Braune's Archiv, 1887, No. 2 u. 3, S. 126.

The author investigated the foetal cord in man. He distinguishes two groups of fibres entering by the posterior nerve roots: one, early medullated (about the fifth month) with fibres of large caliber and lying mesial, the other becoming medullated later, with fibres of small size and lying lateral. The former appear on entering the cord to run mainly to the ventral portion of the column of Burdach, the latter goes chiefly to the most posterior part of the lateral column, the marginal zone (Randzone) of Lissauer. Both groups send small portions directly into the gelatinous substance. After a longer or shorter course all the fibres of the posterior roots enter the gray matter. There are no root fibres which pass directly to the oblongata. The following is the central course of the two components of the posterior nerve roots. The fibres of the mesial bundle pass in several directions after entering the gray matter; one part goes to the column of Clarke, another to the anterior cornu of the same side, to there unite with the cells; and a third to the anterior cornu of the other side, passing through the anterior commissure. The fibres of the lateral bundle pass cephalad for a distance in the marginal zone, then end into the small cells in the posterior cornu. From the column of Clarke there pass out fibres to the direct lateral cerebellar tract, others to the ventral portion of the column of Burdach and in part to the column of Goll, and finally bundles to the anterior cornu of the same side, and through the anterior commissure to the anterior cornu of the opposite side. From the small cells in the posterior cornu pass fibres to the limiting layer (Grenzschicht) and to the column of Goll. In the foetal cord the posterior commissure does not contain any medullated fibres. From these anatomical observations the author draws several physiological inferences which are here passed over.

Verlauf der hinteren Wurzelfasern im Rückenmarke; Aufbau und Degeneration der im hinteren Theile des Rückenmarkes gelegenen, weissen Substanz (bei Tabes). A. TAKÁCS. (Original in Hungarian.) Abstracted in Centralbl. f. Physiol. No. 9, 1887.

The main anatomical results of this investigation are stated as follows: 1. One portion of the posterior root fibres enters the gray posterior cornu, and the other portion the white matter about the posterior cornu. 2. Fibres which enter the posterior cornu pass through the substantia gelatinosa and may be followed to the cells in the column of Clarke. 3. The portion running to the white matter enters the column of Burdach and the posterior part of the principal tract in the lateral column, then bends cephalad and disappears in the posterior cornua of the next three roots. 4. A portion of the fibres which come from the cells of the column of Clarke pass divergently into the column of Burdach and later go to form the column of Goll. 5. The second part of the fibres coming from the cells of the column of Clarke passes outside of the gray matter through the dorsal portion of the principal tract of the lateral column, then turning dorsad and cephalad forms the direct lateral cerebellar tract. 6. The direct lateral cerebellar tract and the columns of Goll are thus formed from equivalent groups of fibres, *i. e.* fibres which have passed through cells in the posterior cornua. These fibres pass cephalad in the cord without interruption, and their number of course increases. 7. The columns of Burdach and the dorsal portion of the principal tract of the lateral column are also mainly composed of posterior root fibres which, however, after a short course, as stated above, enter the gray matter of the posterior cornua. The author further describes association fibres between different levels of the posterior cornua.

Die histologischen Veränderung in den peripherischen Nerven, den Spinalganglien und dem Rückenmarke in Folge von Amputation. E. A. HOMEN. Neurolog. Centralbl. No. 3, 1888.

The author worked on some thirty dogs, from a week old to those adult, and amputated the limbs, usually the hind leg, at the hip or knee. The animals were examined from one day to three and a half years after the operation. The methods used for the histological investigation were those generally employed. In all cases the main change was found in the posterior cornua and the posterior columns of the cord. In those cases involving the lumbar region there was also a slight decrease in the number of cells in the columns of Clarke. The principal change was effected within the first six months, and the first recognizable difference occurred in the youngest and most easily influenced animals at the end of about a week. The operated side then seemed a trifle smaller than the normal. The change took place exclusively in the sensory nerves, but only a portion were involved, and consisted, in part at least, in the shrinking of both medullary sheath and axis cylinder. The spinal ganglia on the operated side were slightly atrophic. In the anterior cornua it was the postero-lateral group of cells which was most affected, and the author looks on them as sensory. Why only a part of the sensory nerves should be affected is not clear. [One value of such an investigation is the light which it throws on the degenerative change, the atrophy which occurs in this case being something quite different from Wallerian degeneration.]

The Cells of Clarke's Column. F. W. MOTT. The Brit. Med. Jour., 1887, Dec. 3, p. 1218.

A demonstration of these cells was made by the author from the cords of the dog, monkey, and man. The cells were bipolar or vesicular, and the long axis coincided with that of the cord. Axis cylinder and processes large. Caudad the cells were connected with the postero-lateral column, while cephalad and laterad they could be seen to be connected with the direct cerebellar tract. The results of degeneration in this region were also demonstrated.

Vergleichend-entwickelungsgeschichtliche Studien im Bereich der Gehirnanatomie. 1. Ueber die Verbindung der sensibeln Nerven mit dem Zwischenhirn. L. EDINGER. Anatomischer Anzeiger, II, 6.

The author studied blindworms about twenty days old by Flechsig's method, and found that the nuclei of the sensory cranial nerves (trigeminus, glossopharyngeus, vagus, acusticus) have, just like the nuclei of the posterior columns, a connection with crossed centres that lie cephalad of them, by means of fibres. The fibres from the nuclei, after crossing the middle line, unite laterad of the posterior longitudinal bundle and pass to the inter-brain in the lemniscus. The relations of this sensory tract are similar in man.

Le système nerveux grand sympathique de l'Ammocoetes (Petromyzon Planeri). CH. JULIN. Anatomischer Anzeiger, II, 7, 1887.

The dorsal and ventral roots arise from the cord in Petromyzon in such a way that they are not mixed, but each nerve has a separate distribution. The dorsal roots have each a spinal ganglion, and both dorsal and ventral roots give rise to a dorsal and ventral branch. In the alimentary tract, and in the auricle of the heart, groups of nerve cells were known to exist. This represents the main bits of information possessed previous to this investigation by Julin. He has found something corresponding to a sympathetic system, which is described as follows: Between the cardinal veins and the aorta lie groups of ganglion cells which exactly correspond in position and number to the individual spinal nerves and are connected, one ganglion to the ventral branch of each nerve. Fibres connecting these ganglia with one another have not been found. The segmental ganglia have, however, fibres which connect them with a deeper series of non-segmental ones that are connected with the heart, alimentary tract, kidneys, and the reproductive organs.

The sympathetic in Petromyzon has therefore two peculiarities. The ganglia forming it are not united by a sympathetic nerve, and since there is a ganglion for each nerve root, and the dorsal and ventral nerve roots are separated, the motor and sensory elements in the sympathetic may be considered as also separate.

Sur les nerfs craniens d'un embryon humain de trente-deux jours. PHISALIX. Compt. rend. CIV, 4, p. 241.

In a human embryo of thirty-two days the author thinks he can make out the spinal type in certain cranial nerves. The trigeminus has besides the motor portion, which is applied to the ganglion Gasseri, another motor portion which passes through the ganglion. The trochlearis appears mixed, receiving sensory fibres from the corpora quadrigemina.

Sur l'ontogénèse du cervelet. E. LAHOUSSE. Bull. de l'académie royale de Méd. de Belgique, IV Série, I, 4, p. 378; Rapport officiel delivré par M. Rommelaere.

The author has found that the histological differentiation of the spinal cord precedes that of the cerebellum. Ganglion cells, neuroglia and nerve fibres form a united whole. The axis cylinder develops later and in a different manner from the rest of the nerve, namely, from the paraplasm. These results were obtained from the study of sections in the adult and developing chick.

Beitrag zur Anatomie des Taubstummengehirns. J. WALDSCHMIDT. Allg. Zeitschr. f. Psychiatrie, XLIII, 4, 5, S. 373.

In a deaf mute forty-six years of age, who could not write, the weight of the brain was 1440 grams. Operculum gyr. front. inf. and gyr. temp. III. were somewhat less developed on the left side. The left island was much less developed and less convoluted than the right.

The brain of a deaf mute girl, nineteen years of age, also showed the principal difference in the island. In both cases the limen insulae was not prominent. The author lays most weight on the convoluting of the island. In four brains of those not deaf mute (among them two of university instructors), the left island was found decidedly more developed than the right. From which it follows that the deaf-mutism is not necessarily connected with the atrophy of the operculum and the associated parts.

Die anthropologische Bedeutung der frontalen Gehirnentwickelung, nebst Untersuchungen über den Windungstypus des Hinterhauptlappens und pathologischen Wägungsresultaten der menschlichen Hirnlappen. TH. MEYNERT. Jahrb. f. Psychiatrie, VII.

The view of Munk that the frontal lobes are the motor centres for the trunk, and that of Hitzig that they are the seat of logical thought, are both rejected by the author. The weight of the frontal lobe in the percent. of the entire brain mantle is: For man, 42 per cent; ape, 35 per cent; dog, 32 per cent; bear, 30 per cent; a result which gives hardly a satisfactory basis for the view of Hitzig. The increased development of the frontal lobes is mainly due to the increased height of the lenticular nucleus and the island. On the other hand it should be borne in mind that the temporal lobe is proportionately as much developed in man as the frontal. In the carnivora it is the parietal, in the apes the occipital, and in man the frontal lobes which are most developed. The peculiar form of the human brain is due to the upright position in man. The paper contains much other matter bearing on the relative development and separation of the lobes.

Ueber die Localization der Gehirnkrankheiten. H. NOTHNAGEL. Verdl. d. VI. Congresses für innere Medicin zu Wiesbaden, 1887.

N. argues for a moderately detailed localization. In the case of the eye, lesion of the cuneus and the first occipital convolution O_1 causes a hemiopia of the retinal halves on the same side. Injury to the adjacent parts of the cortex causes psychical blindness (Seelenblindheit), or, when excited, hallucinations and the like.

He finds no good evidence for the detailed localization of the retinal elements. It is always a question of hemiopia, with one poorly observed case, where an eighth of the visual field was involved, as an exception.

The author's views on the localization of vision in the cortex are as follows: 1. The cuneus and the O_1 form the field for visual perception. Their lesion on one side causes hemiopia; on both, complete blindness. 2. The remaining occipital cortex is the seat of the visual pictures (Erinnerungsbilder). The limits here are very uncertain. 3. If on one side the cuneus, O_1 and the other part of the occipital region are thrown out of function while, on the other side, the occipital cortex, with the exception of the cuneus and O_1, are thrown out, then there occurs, corresponding to the former lesion, hemiopia and, to the latter, psychical blindness.

The author points out that in the case of the complete cortical paralysis of an arm, for example, patients can often, with the eyes closed, imitate with the sound arm the position in which the paralyzed one is placed. Starting from this fact, the author reaches, as the conclusion of an argument, the view that the centre for what is designated as the muscle sense is in the parietal lobe, while the sensations from the skin are centered in the motor region, about the central convolutions.

The name "psychomotor" for the centres about the central convolutions, for example, is not satisfactory, because a patient with cortical paralysis is capable of the mental process of willing the movement of a part but cannot carry out the operation, hence the psychical progress cannot go on in the part which is destroyed and causes the paralysis. The motor centres of the authors are neither the places where the impulse originates, nor even the place where these impulses are co-ordinated, but merely spots at which they pass over to the coronal fibres. The parietal lobe is to be considered as bearing the same relation to these motor centres that the part of the occipital lobe about the cuneus and O_1 does to the visual centre itself. The author considers this view capable of extension.

I mielociti e il pensiero. C. GOLGI. Arch. di Psichiatria, VIII, S. 206.

Pouchet has recently advanced the view that the psychical operations did not take place in the nerve cells proper, but in the small cells, 5–6 μ. in diameter, described by Robin under the name of myelocyts. Against this view Golgi argues that the cells in question have not been proved to be nervous. Pouchet further surmises that each neuro-epithelial element, as in the retina, for instance, is in connection with one of these myelocyts, and then proceeds to calculate that the perception of a moderate-sized object, *e. g.* a letter "X," would at most bring into activity a quantity of gray substance equal to 660 cubic millimeters. Golgi points out that independent cells and groups of cells do not exist in the central nervous system, and that we have no data for placing a limit to the spread of a stimulus.

Physiologische und mikrochemische Beitraege zur Kenntniss der Nervenzellen in den peripherischen Ganglien. ANNA KOTLAREWSKY. Inaugural Dissertation, Bern, 1887.

Following Ehrlich's method, the author has stained the ganglia in the living animal. The small cells stained more intensely than the large, and the reaction appeared to be neutral or slightly alkaline.

The study of hardened specimens showed that the character of the cells could be inferred from the form, and that the chromophile cells always had a greater affinity for the metal solutions than the chromophobe. Staining led to the conclusion that lack of chromatin matter in the nucleus was accompanied by staining of the protoplasm by various reagents.

Sur la morphologie comparée du cerveau des Insectes et des Crustaces. H. VILLAUES. Compt. rend. CIV, 7, p. 444.

In insects and decapods the brain consists of three parts, homologous with three ganglia of the ventral chain. The anterior innervates the eyes; the middle, the small antennae in crabs, the antennae in insects; and the posterior, the large antennae in crabs, the upper lip in insects. Only the halves of the first two are directly united by commissures. The posterior halves are united by the oesophageal commissures. Each of the ganglia is supposed to represent a somite.

II.—HYPNOTISM.

Les demoniaques dans l'art. J. M. CHARCOT (de l'Institut) et PAUL RICHER. Paris, 1887, 116 pp.

This work, richly illustrated with 67 plates, some of which are elegantly produced, is an attempt to trace among the more important works in the history of pictorial art, those which depict hysteria and convulsive diseases generally. The first is a full-page reproduction of a mosaic of Ravenna of the fifth century, representing Jesus healing a demoniac. Miniatures, mural frescoes, bas-reliefs, tapestries, engravings reproduced in various ways and representing exorcisms, energumens, miracles of healing in the New Testament, conversions and cures at the tomb of the Archbishop of Paris, the ceremonies known as *les grand secours* or more or less ceremonious compressions and flagellations, ecstasies, etc., follow, coming down to the middle of the last century. In the fifth and sixth centuries, it is said, such cases had a sacred character. Later, in depicting scenes from the life of the saints, the artists are dominated by a religious spirit. At the time of the Renaissance they followed the development of luxury in the churches; then with the Italian masters, and with Rubens, they have a most sumptuous aspect. The Spanish artists represent everything in the face and in gesture. The school of Breughel reproduces the details of the popular dance of St. Guy. These symptoms are given an anecdotic character first in the time of the convulsionaries of St. Médard. A clinical criticism of the work of the various artists, which is also attempted, represents André del Sarti and Rubens as very faithful to nature, and Raphael as full of untruths and contradictions. The work thus affords a new basis of art criticism, and proves that this group of symptoms is very old. The last few pages are given up to illustrations of the convulsionaries of to-day, exhibiting contortions, "clownisms," opisthotonus, etc., as seen in modern cliniques, as bases of comparison with the above representations of demoniacal possession.

Les maladies épidémiques de l'esprit, sorcellerie, magnétisme, morphimisme, délire des grandeurs. Dr. PAUL REGNARD. Paris, 1887, 429 pp.

This book, which is illustrated with 120 engravings, is, like the preceding work, of a somewhat popular character, but is more miscellaneous. The first part deals with diabolic pacts, the sabbat, sigilla diaboli, magic scriptic characters, and other attendants of sorcery, which is called a creation of despair. Cuts from the seventeenth century show the various forms of attack at home, in the church, on the street, characteristic contractures. The process of the witches' Sabbath is depicted in cuts illustrating the departure, the journey, the transformations, characteristic goblins, parody of every sacred rite of the church, cooking and banqueting on toads and babies. Then follow illustrations representing flagellation, torture of witches, rites of exorcism. A long chapter is devoted to the miracles of Saint Médard, with full and illustrated history of six cases, followed by cuts illustrating similar hysterical paralyses and anaesthesias, meteorism, crucifixion-attitudes, etc., of to-day, curable by suggestion. Much space is devoted to Mesmer and his baquet, which is thought to be related to the monotonous, contemplative asceticism of the fakirs. Minute and illustrated directions for producing each of Charcot's three states show how minutely faithful is the author's discipleship of Charcot, to whom the book is dedicated. Then follow sections on opium, with pictures of all the stages in its growth and manufacture, sale and use. Finally come illustrations, in the form of poems, letters, drawings, script, etc., of delirium of greatness. The pathologic character of each age is indicated as follows: Magic was the epidemic of the fifteenth, sixteenth and seventeenth centuries. St. Médard summarizes the mental maladies of the eighteenth century. Somnambulism began in the seventeenth and has its great field in the nineteenth, the century also of morphonomania and widespread democratic delusions of greatness. The psychic pestilence of the twentieth century may be a delirium of carnage, blood, destruction. In this of course the allusion is to the European war prospects, over-population, and Nihilism.

This work makes almost no pretensions to a scientific character, and as an historical study is of very slight value. We believe its tone and taste throughout to be as unwholesome as the curiosity of the ladies and gentlemen to whom these lectures were addressed. A purely miscellaneous collection of psychic aberrations of this highly imitative and contagious type, not explained but merely depicted, is perhaps less vicious than public exhibitions of hypnotic phenomena, but can serve no useful end, and could not absorb the energies of a mind of scientific type intent upon their scientific elucidation.

Animal Magnetism. ALFRED BINET and CHARLES FÉRÉ. London, 1887, 378 pp. International Scientific Series, Vol. LX.

This is the only work in English that attempts a systematic presentation of the results of the study of hypnotism which has been carried on so assiduously for the past eight years or more by physicians, physiologists, neurologists, alienists and jurists, etc., in France. The subject is full of both scientific and practical interest, and we commend this book to physicians and students of psychology of all

schools. One French physician declares that hypnotism has already contributed results as important for the scientific knowledge of disease as bacteriology, and is likely to be even more practical in the treatment of a large and, in our age, a rapidly increasing class of maladies. Another asserts that somnambulic hyperaesthesia and mental exaltation supply the experimental psychologist with an instrument likely to prove as important for clinical medicine as the invention of the microscope for the pathologist.

This work opens with an historical sketch of the subject from Mesmer and Braid to Liebeault and Heidenhein. Those who have the hypnotic neurosis may be hypnotized, at least after more or less education if not at first, by the noise of crumpling paper, the tick of a watch, the beat of a gong, the odor of musk, a bright light, looking at not only a button but at their sewing, by a fixed attitude as of prayer, and by gazing in the mirror, contact, even accidental, with a hypnogenous zone, by suggestion, which may act by causing an intense memory-image of fatigue, etc. Some, it is said, may be hypnotized, not only against their will but without their knowledge, or even asleep, or by the proximity of an unsuspected magnet. Touching a pre-designated object; looking at an imaginary lamp; the bark of a dog, or the advent of a time appointed days or even months before, may cause this state.

The symptoms of hypnotism must be studied by defining most carefully the physical states of the subjects, and also the processes employed, and by beginning with simple and physical as opposed to mental phenomena. Thus Charcot's famous three states or nosographic groups were formulated in 1882, and have been much further studied by his pupils. I. Lethargy. This is marked by muscular flaccidity, closed eyes, and dull senses. Localized contractures are caused by pressing muscles, or excitement by touch, magnet or faradic current in nerves or tendons which persist in the limbs but not in the face. Three characteristic attitudes of the hand, caused thus by different local stimulus (ulnar, median and radial), are distinguished. If the limb is restrained from contracting upon such stimulus, the antagonist muscles soon act. These local effects are said to be transferred to the corresponding part of the other symmetrical median half of the body by a magnet, and by arresting circulation in the stimulated limb the contracture is made "latent" and appears as an after-effect of the stimulus when the ligature is first removed. II. The cataleptic or fascinated state, of a waxy flexibility, without tendon reflex, or neuro-muscular hyper-excitability. The extended limb does not tremble as it does if held in position by the will. The face takes on the expression of the same sentiment expressed by the attitude into which the limbs are placed. III. The somnambulic state is the most complex, and is marked by hyper-sensitiveness whether to sensations or to suggestions. The slightest touch or breath often causes muscular contraction, of less local character than that resulting from the much stronger stimuli exciting contracture in lethargy. In somnambulism the various hyper-excitable spots or zones—erogenic, reflexogenic, dynamogenic, hypnogenic, hysterogenic—are best studied. The magnet may change the rapport of elective somnambulism into hate. Thus it is claimed that using only strongly hysterical subjects, the existence of three clearly demarcated experimental nervous states is established.

This fundamental study of physical characteristics distinguishes the conclusions of the Paris investigators from those of Bernheim

and his school at Nancy, who do not find the muscular effects constant, and thus do not recognize the first two of the above states as distinctive, doubt the influence of the magnet, and believe all hypnotic phenomena due to suggestion. All, however, admit that suggestion may reproduce and magnify every fact of mental life, the dominion of suggested ideas being due to their increased intensity caused by psychical hyper-excitability. In the study of suggestion, simulation and unconscious suggestion must be rigorously excluded. The exploration of its effects has but just begun, for in a fit subject it seems able to produce all the actions possible for the nervous system, and what are the limits of what the nervous system can do is at present unknown. Focachon caused vesication by suggestion with the aid of a plaster made of postage stamps in twenty-four hours, the patient being watched and the blister photographed. Epistaxis and even blood sweats are thus produced. Any part of the body of an hysterical patient is proven by Mosso's process to change in volume, as *e. g.* a limb, by fixing the attention on it. Commonly ideas are secondary products; they are resultants developed from below upward. Suggested processes, conversely, are epi-phenomena; they begin in the centres of ideation and are developed to lower planes. This makes facts like the above and psychical paralysis entirely inexplicable on the theories of any of the existing psychological schools. In the hallucinations of hypnotism, subjects can add imaginary figures; receive wounds which they see, feel and dress; clasp imaginary objects; be transformed to a dog, a piece of glass; see correct mixtures, contrasts, and after-images of imaginary colors, of imaginary objects that are doubled if one eye is pressed, or a prism placed before one, and that are magnified by seeing them through an imaginary opera glass or microscope. Hallucinatory portraits are seen on blank cards, or on cards already photographed with entirely different faces. In viewing imaginary objects, convergence and pupillary aperture vary correctly with their changing distance. Sometimes these hallucinations persist in a waking state and are believed. Any commanded act whatever, though with varying degrees of resistance, is done, criminal though it be. Paralysis, which may be complete for a single limb or for all the muscles on one side of the body, can be caused by suggestion, and this is usually attended by an anaesthesia so complete that the subject really loses the limb, and must find it by searching with the eyes or other hand. Aboulia for a single act may be caused while all others can be done. He is unable *e. g.* to write the word *not*, while he can write all three letters in other combinations. Even this is said to be attended with reduced muscular power in the hand as tested by the dynamometer. The phenomena of the transfer of motor or sensory disturbances from one bilateral half of the body to the other, are described, and the work closes with a brief statement of the forensic and therapeutic aspects of hypnotism.

The book is a very useful and timely one, but is quite diffusely written. We should far rather have had a treatise written by a representative of the Nancy school of hypnotism, with less stress laid on the agency of magnets and action at a distance. The standpoint of these authors is but half scientific. This, we think, will become plain in the further discussion of the subject in this journal.

De la suggestion mentale. Dr. J. OCHOROWICZ. Paris, 1887, 541 pp.

This work is by an ex-professor of psychology and philosophy in the University of Lemberg. Its chief purpose is stated in a brief preface by Ch. Richet to be to prove that, outside of all phenomena appreciable by our normal perceptive powers, however acute, there exists between the thought of two persons a correlation that chance cannot explain, and its leading motto is Arago's sentence, that whoever, outside the sphere of mathematics, pronounces the word *impossible*, is lacking in prudence, for the limits of the possible are ever widening. The first part (five chapters) of the book is devoted to the author's observations. Suggestion to blindfold subjects by slight noises like the rustle of silk, the suggestive noise of Baréty's cuffs as he "projected the fluid" to one of his subjects, etc., by which hidden gestures are imitated and persons distinguished, the explanation of Charcot's stages, especially catalepsy, as "ideo-organic association" formed by hypnotic education, the criticism of tests for catalepsy (which consist commonly in lifting the arm which remains elevated in that state and otherwise falls, as existing or not as it is suggested or not by the motion of the lifting hand, which differs if the arm is expected to fall, from what it is if it is expected to remain), his insights that while pressure on the vertex causes religious ecstasy in Manchester, lethargy at Breslau, and somnambulism at Paris, it is suggestion in each of these centres of research that is the real cause, and that every thought having spacial reference tends to provoke unconscious but suggestive movements, his study and explanation of "Cumberlandism," or muscle-reading, by this principle which he termed in a former paper ideo-plasticity, and by which he literally found a needle a lady had hidden in a hay-mow, his recognition of the high hypnotic-pedagogic significance of even a very few seances in creating habitual reactions, and that thus polarities and aesthesiogenic points are developed—all these and many other criticisms of the author's observations on his own subjects and those of others in the many cities he had visited in quest of light in this dark field, indicate a cautious and critical mind, favored, as he remarks, by his early bent toward positivism. In the second chapter, mental suggestion, however, had grown from apparent to probable, and in the third it becomes "genuine." This last stage of conviction, we are told, was attained a year before publication, although he had studied and experimented since 1867. Although he has passed from the first skeptic stage of Gorgias where it is impossible to know the truth, it is only to realize that, being known, it is wellnigh impossible to state it, at least in terms consonant with the clumsy theory of association, and still less in the pretentious philosophical volapük of Kant and Hegel. The romance of the "elegant and intrepid" Hartmann gives us a better principle in the unconscious which is the real prestidigitateur, although so poorly defined. *True* mental suggestion Ochorowicz at last found with "Mme. M., aet. 27, strong, well made, and apparently in perfect health," but with all sorts of extreme hysterical symptoms, a vicious heredity, hysterogenic and delirogenic points, etc. Putting her in the "aïdeique," and then in the somnambulic state, and sitting out of her field of vision, he willed the order, "lift your right hand." At the end of the third minute and after much "agitation," although he is sure she could not have seen him, she lifted the left

hand. Other willed orders (rise, come to me, give me the bracelet, the hand, etc.) were executed with different degrees of fidelity. Hence he was led to his theory of the three states, aïdeique, monoïdeique, and polyaïdeique, active and passive, and that the true instant of mental suggestion is when the aïdeique state passes into passive monoideism. Being now essentially convinced of true mental telepathy or suggestion independent of action through the ordinary channels of sense, the author was visited by Mr. Myers, of the London Society for Psychic Research, and himself visited Havre, Paris and other places, still troubled by his doubts which frequent failures kept alive, but on the whole more and more convinced that sensations and ideas could travel through space as well as be transferred to a foetus. Heredity, in fact, may be conceived as unconscious mental suggestion. Mental may even succeed where verbal suggestion fails.

Part second is devoted to facts observed by others, which are classified as, first, transmission by organic sympathy from the surface of the body; second, sympathism and contagion, by touching in particular parts or moving the hands over the body in a particular way. In this latter chapter is a very interesting résumé of facts from many sources, on the different odors emanating from different parts of the body, and from the body as a whole in different emotional and hygienic states. The large body of facts now collected by Monin, and the experiments of Adamkiewicz and others, make it probable that not only quite localized sweats, but other osphresiologic anomalies are more general than has been thought. Even professions and vocations, as well as some diseases, seem to have often characteristic smells; so that disease, etc., "does not cease at the surface of the body." All such facts favor the fluidists. Yet "physical contagion has no interest," but only nervous contagion, which may be psychic, or physico-magnetic. A molecular equilibrium tends to be established between all bodies which approach each other. Motor states as well as pains may be transmitted, prejudice is not invented, but stimulated telepathically, as the author thinks the English society have shown. The same is the case with ideas and will. Not "me" but the unconscious of perhaps a "second order" is the seat of the mysterious inoculation. Part three is devoted to theories, conclusions, and applications. Brain or sense exaltation attends true action at a distance. Finally, mental suggestion must be regenerated by positive science, and will then mark a "new epoch of renaissance," by "translating in clearer accents the mysterious echo of current verities."

This large volume is a valuable thesaurus of facts and opinions, superficially grouped, animated in the first part by a personal and almost confessional element, but contains not a few repetitions, is vague in just those points where clearness is essential to its theories, and is written with little conception of the nature of the unconscious so often appealed to. In the author's wrestlings with successive theoretic interpretations which have been so long and so serious, and in the confidences to which he invites us, we behold a mind with a passion for candor so uncontrollable, and with a habit of hovering on the sharp edge of indecision so inveterate, that one is incessantly drawn away from the subject to interest in the author. We are sure his chief mistake is in believing that his so recently adopted conclusion of a purely mental suggestion is really the final outcome of his own studies in his own mind.

Le magnétisme animal etudié sous le nom de force neurique rayonnante et circulante. Dr. A. Baréty. Paris, 1887, 662 pp.

This is not only the largest but perhaps the most systematic, so far as tabulations, full definitions of terms in a glossary, an index of over thirty pages, etc., can go, of all the French treatises thus far produced in this field. It contains eighty-two illustrations. Dr. Baréty squarely assumes in the preface that he has to do not with hypnotism, Braidism, or suggestion, but with a force within the human body that can pass its limits and influence other bodies, and can be stored up in fluid and solid substances. This force is seated or developed in the nervous system, is called neuricity or neural force, and may be static or dynamic. If the latter, it circulates along the nerve fibres and also diffuses or irradiates outward. Irradiation of this force may be ocular, digital, or pneumic. Of its many properties, those which act on living substances are called physiological. This force is propagated rapidly, along straight lines, may be reflected like light, and even refracted in a neural spectrum. It passes through many bodies and through some colors, the latter being thus distinguished as dianeuric and aneuric. Yellow paper, and complementary yellow, *e. g.*, completely intercept ocular and digital but not pneumic neuricity, but loses its aneuric properties if wet with a solution of quinine. Water is completely aneuric, but can be charged with neuric force. The different methods of neurization by contact, at a distance, by reflection, etc., are described. Fixed digital radiation can cause anaesthesia, hyperaesthesia, contraction, sleep general or of individual senses. Mobile digital radiations or passes, if in the direction of nerves, cause anaesthesia and contractions; if in the opposite direction, hyperaesthesia and muscular relaxation. Thus the direction in which the nerves pass or are distributed to the skin is basal for the determination of zones. Anaesthesic passes, *e. g.*, each side the nose must be downward, on the forehead upward, on the cheeks they must follow the facial nerve forward, must ray out in all directions from the superficial cervical plexus. If passes are from the forehead directly over the top of the head down to the neck, anaesthesia is caused in the front and hyperaesthesia in the back of the scalp, where nerves are distributed upward. The face is thus divided by a number of zones, lines delineating the "part" in the direction of nerves. On the inside of the arms, upward passes cause anaesthesia; on the outside, hyperaesthesia. Light passes down the back and up the face of the fingers cause flexion and insensibility; in the opposite direction, hyperaesthesia and extension, and so on for the rest of the body, the eye being often quite as effective, and all this part of the subject being copiously illustrated. Blowing is more irradiated across boundary or zone lines, is more subject to transfer, and can exalt the sensibility of eyes and ears. In contact between the magnetizer and his subject, the latter is made anaesthesic if the nerves of the parts in contact are distributed in the same direction; hyperaesthesic if in opposite directions. Liquids and solids may be neurized by blowing, by touch, and sometimes by the eyes, and thus become condensors or accumulaters, or magazines of one or more of these three species of force. Opposite parts of these substances, however small, may be neuralized in opposite senses. A square bit of paper breathed upon causes joy if applied anteriorly to the body of a good subject, and sadness if applied posteriorly. With subjects previously rendered anaesthesic, dorsal rays of force passed

through a prism cause sadness if they impinge on the dorsal side of the subject's hand, and happiness if on the palmar side, and conversely of palmar rays, with a region of indifferent rays between. The force was later found to be conducted along the hair of the subject; through the body of a third person, unilateral phenomena were developed, new points of contact for exciting partial waking in sleep, or other specific reactions were discovered.

We have no further space to detail the maze of discoveries of laws and deductions, all derived from the study of one hysterical girl of eighteen. The last part of the book describes very briefly, and with little attempt to confirm the above results, eleven other cases of patients who showed some of the more common phenomena of hypnotism. Quite apart from all question of the validity of all these theories, they have a suggestiveness of their own as a joint product of pseudo-scientific methods gradually evolving a set of systematized symptom-reactions in an interesting hysterical subject, half whimsical originations, half subtle divination of theories of the experimenter almost before they are known to himself.

Découverte de la polarité humaine. Dr. CHAZASAIN. Paris, 1886, 29 pp.

The positive pole of a magnet, when applied to the external side of the hand or arm, foot or leg, and on the left side of the trunk and head, causes contracture, as also does the negative pole if applied to the inner side of the limbs and the right side of the body. Resolution of contractures is produced by converse applications, viz. the positive pole to the inside of the limbs and right side of the trunk. This is all duly shown by diagrams. The + and — electrodes from a constant current produce the same effects. These effects are all transposed in left-handed subjects. The so-called laws for the separate fingers and their parts are too complex for statement here. If one person touches a part of like polarity of another person, such "isonomic" contact causes contracture, while "heteronomic" contact is decontractive. Isonomic contact is also anaesthesic and reduces muscular energy; heteronomic is hyperaesthesic and increases it, and polarizing action is in general hypnogenic. Extending the hand heteronomally attracts a subject "as by an irresistible force," while isonomic positions repel. The law of transfer is derived from that of polarity, which is common to animals and plants, all being bipolar, while minerals are unipolar.

For those impressed by such conclusions it would be interesting to know how this author reconciles his conclusions with the very diverse but no less remarkable laws of Baréty.

La suggestion mentale, et l'action à distance des substances toxiques et médicamenteuses. Docteurs H. BOURRU et P. BUROT, professeurs à l'École de Médecine de Rochefort. Paris, 1887, 308 pp.

The studies here reported began in 1885, with a young man who was subject to violent attacks of hysteria. The other principal subject was a young woman. It was found that non-volatile substances placed in the hand or behind the neck of these subjects produced characteristic effects, markedly distinct, rapid and intense. In some later cases the following suggestions of Richet were observed: 1. The operator did not know what the substance was which he held either in a tightly sealed bottle or wrapped in paper, either in con-

tact with or near the subject. 2. He diagnosed from the symptoms whether it was tetanizing or emetic, morphine or water, which latter had no effect, and the problem was whether pure chance which would make one in four of these reactions right was improved upon. The results are said to have been obtained when the substances were applied while the attention of the patient was diverted and without the possibility of his knowledge. Other physicians, Dumontpellier, Thomas and Pascal in Toulon, Dècle, Chazasain and Dufour, and an officer Rochas, have announced analogous results of their own observations, which are, however, less extended than those of Bourru and Burot. The substances experimented with, besides the metals used in the metallo-therapeutic tests at first made, may be thus grouped: 1. Narcotics (opium, morphine, chloral, hashisch, atropin, narcein, codein, thebain, narcotin); 2. Emetics (apomorphin, ipecacuanha, tartarus stibiatus); 3. Purgatives; 4. Alcohols; 5. Antispasmodics (especially valerian and camphor); 6. Anaesthetics; 7. Excitants (phosphorus, nux vomica, cantharides, jaborandi and pilocarpin). Even within these seven classes the different substances often produced well differentiated symptoms, which are illustrated by ten photographs. A grave difficulty of interpreting principal from accessory symptoms is admitted, or, as we should prefer to infer from the data, the special from the general symptoms. The alcoholic symptoms seem to be most marked and most differentiated according to the form in which alcohol was used. Besides these effects, gold and mercury, the latter when hermetically sealed in a tube, produced striking effects, but with most substances sealing the glass destroys the effect. The time of application needful for generating the symptoms; the after action after the stimulus is removed, which may cease at once or may last several days; the ratio in which increasing the strength of the substance or uncovering it increases, as it confessedly does, the effects; the phenomena of physiological antagonism—all these points are left very undetermined. These facts may be called experimental determinations, and the substances act in some way by disrupting for a time the equilibrium of the nervous system.

The second part of the book is devoted to explanation of the facts. Suggestion, whether by way of expectant attention, mental, or autosuggestion, is rejected. If there be suggestion it must be without words or gestures, and even without thought; and as the former consists in the transmission of psychic states inappreciable to the normal perspicacity or senses, the transfer cannot pass through the medium of intelligence.

Metaloscopic phenomena are most analogous to those here described. In fact it is concluded that the action of metals, woods, magnets and currents of electricity, and that of medicaments at a distance, are phenomena of one and the same order. A cut illustrates the alleged magnetic attraction of the fingers extended towards the side of his head upon the body of the patient. Even Baréty's theory of irradiating neural force is approvingly stated. Magnetic force is the term best adapted to explain the facts. These discoveries can be applied in making a physiological analysis of medicines and persons, in testing, without danger, the impressibility of individuals for substances, in codifying the hitherto empirical action of curative agents externally applied, and in opening up a new therapeutic method.

This work is the best presentation of its class of phenomena, and

is exceedingly well arranged and clearly written. The most striking of its many defects is, however, the failure to adequately appreciate the subtlety of the sense of smell, which in many experiments, some of which have been described in this journal, is shown to be sometimes, even in the normal subject, almost incredible.

Les emotions chez les sujets en état d'hypnotisme. H. Luys. Paris, 1888, 106 pp.

This well known, somewhat speculative but reputable neurologist has also fallen to experimenting with a hystero-epileptic woman, 20 years of age, named Esther, of whom he publishes 24 instantaneous photographs illustrating her emotional reactions to 87 different substances—mostly drugs—at different distances. This subject had been a dancer and singer, was of an eminently theatrical temper, and was possessed of "a richly furnished imagination," her "exquisite sensory apparatus" was set in action by infinitesimal vibrations. The effects produced by the different drugs were emotional. Each substance disturbed the equilibrium of the entire nervous system, so that each emotional fibre when set in vibration by the different drugs produced expressions and attitudes of fear, disgust, jollity, tenderness and passion. Even trophic effects were obtained, but not specifically studied. The emotional effects vary much with the distance of the substance, also with the motion of the flask containing the substance over or even near the skin, and still more as it is applied to the right or left side. When we reflect, however, on the fact that the range and acuteness of the sense of smell is but little known, but that from what little is known it seems incredibly fine, that some drugs are known to owe their chief medical effect to smell, that in an hysterical organism everything is possible; that the expression of many of these photographs does not correspond to the known effects of the drugs—it is plain that the experiments of Luys were as inadequate in caution and number as his conclusions are hasty. Swelling of glands, turgescence of the face, exophthalmia, respiratory and cardiac modification, nausea, etc., are also produced and interpreted as accessory emotional effects. If the tube in which the substances were placed is empty, the reactions of the subject are interpreted now as after effects of a previous substance, now as reactions *per contra*, now as a chemical effect due to the substance of the glass itself, now as caused by air currents or coolness in approximating the glass, etc. Surely by such tests on such a subject an experimenter can prove anything, fantastic or hysterical caprice though it be. There is a ludicrous element brought out in these photographs that is irresistible. The author approximates a tube containing essence of thyme to Esther's neck on the right and her face expresses terror. When the same substance is brought around to the left of the neck she looks happy and contented. If applied to her finger it itches and Esther is depicted in the act of searching for an imaginary louse. Ipecac shows Esther about to vomit. Cognac thus applied is said to have caused the attitude photographed as Esther drunk. Water causes a scowl called hydrophobia. Under the action of valerian she is depicted as scratching gravel with her hands, while in no less than six of these photographs, interpreted as illustrating six different emotions, Esther's chief expression is exophthalmic.

Der moderne Hypnotismus, ein kritisches Essay. Prof. SEELIGMÜLLER. Deutsche Med. Wochenschr., Jan. 5 and 12, 1888.

These articles constitute the beginning of a series as yet incomplete. The first is chiefly occupied with an account of the work of Bourru and Burot (reported above). The second shows that the experiments with drugs at a distance (which were sometimes applied without wrapper, sometimes in paper, in open, now in closed, now in corked tubes stopped with various waxes, gums, etc., and now hermetically sealed), were more quickly and intensely successful the less the substance tested was closed. The greater the dose, the greater the effect. At first no difference was made between odorous and non-odorous substances. With some subjects it is, with others it is not, important to which part of the body the application is made. There seems to be no education, and the first experiments are usually best. The precautions are shown to be often ridiculously inadequate. Ether is said to cause fascination, for a very intelligent lady who had experienced it assured the Rochefort sages that this was the case, etc. The conclusion here reached respecting nearly all the experiments on the action of drugs at a distance is that they have been made "with an ignorance, a prejudice, and a lack of common sense unprecedented in the history of modern medicine." If an experiment does not succeed, it is a new and unexpected effect, revealing, perhaps, a hitherto unknown property of the drug, or some other new explanation is at once proffered.

De la suggestion, et de ses applications à la thérapeutique. H. BERNHEIM, professeur à la Faculté de Médecine de Nancy. Deuzième édition. Paris, 1888, 596 pp.

This we regard as on the whole the most scientific of the many works that have appeared in France within the present decade upon this subject, and we deem it a matter of serious regret that writers representing this method and standpoint were not chosen by the publishers of the International Scientific Series to present the subject to English and American writers, in preference to such thoroughgoing partisans of the school of Charcot, which, after its great service in giving a memorable impulse to studies in this field by introducing a new ideal of scientific method, has been latterly so reluctant to accept the far better methods and results of Nancy, that discredit, not only for the Paris school but for this field, is imminent. The study of hypnotic phenomena at Nancy, which, began on the present lines by Liebeault, a student hardly less diligent and sagacious than Braid himself, and who had the advantage of coming after that investigator, has led to very different conclusions respecting hypnotism from those reached at Paris or Toulon. The school of Nancy believes that the so-called physical phenomena of hypnotism, including those of Charcot's three states, are purely psychic, that hypnotic sleep is the same as natural sleep, and that in the latter the same phenomena can be obtained as in hypnosis artificially induced in the same subjects, even catalepsy, hallucinations, transfer, contracture, and automatic movements, etc., all appearing on suggestion; that hallucinations are only suggested dreams, and dreams are only spontaneous hallucinations; that without suggestion hypnotic subjects remain torpid and inert, and really in natural slumber; that hypnotism is therefore not pathologic and has no necessary affinity with hysteria; that hys-

terical phenomena are often developed either spontaneously from the too common association with magnetism and hysterical manifestations in the subject's mind, or else suggested more or less unconsciously by this association in the mind of the operator; that no one can be hypnotized unless he has the idea he is to be, so that the sleep itself is an effect of suggestion, and, like all its phenomena whatever, is due not to magnetic or any fluidic influence, or to any physical stimulus or manipulation, but solely to psychic impressions. Experiments where the conditions have rigidly excluded suggestion have not succeeded at Nancy. Bernheim has tried "with hundreds of subjects" to produce transference of thought without suggestion, such as Gibert of Havre, Mr. Myers of London, Perronnet, Ochorowicz, Janet and others in France, think they have obtained, but in vain. These phenomena and the action of drugs at a distance, if they be real, are facts of an entirely different order from those obtainable here. Bernheim believes that suggestibility exists in the normal waking state, but that it is neutralized or repressed by reason, attention and judgment. In sleep these faculties are enfeebled, impressions are accepted without control and transformed into movements and images. This psychic modality or new consciousness makes the brain more docile and plastic to suggestion, and more apt to react on the functions and organs either by inhibition or dynamogenesis. It is this aptitude, exalted by suggestion, that is effectively utilized for therapeutic ends. The supposed action of drugs at a distance is thus explained. The subject concentrates all his disposable nervous energy upon organs on which attention is focused to divine, with extremely hyperaesthesic sense, what the experimenters wish to obtain. Knowing that they are to get the effects of a substance in a sealed bottle, they begin with vague symptoms, like malaise, anxiety, agitation, nausea, which are effects common to most poisons—alcohol, opium, emetic, valerian, etc.

If among those present knowing the substance some one is struck by the first manifestations and translates their sentiments into words, the cue is instantly seized. If there are no words, then the physiognomy, gestures, the least index of approval or disapproval, are eagerly sought and divined with amazing acuteness; and if all these are absent, and even no one, not even the experimenter, knows, and all subtle odors are effectually eliminated, the experiment fails. Upon this conception of the nature of these phenomena, it is said therapeutics is best able to utilize what is claimed as one of the most important conquests of contemporary medical science.

Bernheim tells a new subject that he or she is to be put to simple normal sleep. It is well if the subject has first seen others hypnotized to see how simple and perhaps helpful it may be. He uses the command "sleep" after describing to them optical symptoms of sleep which he assures them they feel; but if they do not sleep, they are assured that sleep is not needful for hypnotic effects. Some subjects fixate first and then the eyes close, or are closed by the operator, and thus the image or suggestion of sleep is insinuated into the brain. Passes, fixation, etc., are not absolutely necessary, but serve only to concentrate the attention. The operator continues to say in ever lower tones, "You feel heaviness in the eyes and torpor in the limbs, the nervous system grows calm, sleep is coming," etc. With others a more brusque, authoritative method must be employed; with others the idea of being chloroformed was effective, or a few sniffs of chloroform, alone quite ineffective, cause sleep with the aid

of suggestion. It is not neuropathic or hysteric persons who make the best subjects or who are less apt to react by contra-suggestion, but those accustomed to obey passively. In place of the six theoretic stages of hypnotism by Liebeault, beginning with heaviness of the eyelids, and ending with perfect somnambulic response to the operator's will, Bernheim makes nine stages, divisible into two groups. In the first stage all signs of sleep are uncertain, but there is a nervous calm in which sensations of heat can be provoked by suggestion in different parts of the body, and certain pains can be destroyed and therapeutic effects secured. Hypnotism is defined as "the provocation of a particular psychic state in which suggestibility is augmented." This state need not necessarily be sleep, for catalepsy, anaesthesia, paralysis, and hallucination can be provoked without sleep. The highest degree of hypnotism is marked by amnesia on awakening, and by the possibility of hallucinations both hypnotic and posthypnotic. The term negative hallucination, applied to cases *e. g.* where objects within the field of view become invisible by suggestion, signifies that objects perceived are neutralized by the imagination, and not as the Paris school conceives, that perception is inhibited. Hypnotic achromotopsia and amaurosis are purely psychic. The modifications of circulation and respiration which characterize hypnotism are said to be due to emotions. The phenomena of instantaneous hemorrhage on any part of the body obtained by Dr. Mabille, and by Bourru and Burot, which resemble the self-suggested stigmata of Louise Lateau, which succeed only with the most rare subjects, and which Bernheim cannot produce, must be grouped with blushing, secretions, flushes, etc., under influences as truly psychic as the effects ascribed to magnets. Transfer and many other phenomena can be produced in the waking state by suggestion, and illustrate the same order of facts as Braid described in 1846 in his pamphlet entitled *The Power of the Mind Over the Body*. Suggestion without hypnotism may also account for the insensibility to torture, caused by ecstasy in the case of martyrs and victims of the Inquisition. The Nancy school has not been able to verify either the somatic or psychic symptoms of the three stages of Charcot, but manifests the signs of somnambulism, catalepsy, or lethargy at suggestion without rubbing the vertex, opening the eyes, beating a gong, touching or blowing on the skin, etc. In fact these processes have no effect of themselves. This is the conclusion also of all the experimenters of Nancy, and even of Liebeault, who during the last twenty-five years has hypnotized more than 6000 persons. The Salpêtrière subjects, besides being all hysterical, have been a long time in the hospital, and have come to reflect a false theory, the joint product of doctors and patients. Thus the manipulations of a special culture which unintentionally suggest reactions conformable to the theory, imitative of typical reflexes in other patients, have developed in this environment a species of hypnotism that is unnatural. Again, severe hysteria (the Paris theories rest on not more than twelve cases) is very rare compared with the very many common cases on which the Nancy conception of hysteria is based. Nothing, says Bernheim, is more curious than the errors of Binnet and Féré in supposing that they could rely on alleged symptoms of lethargy and catalepsy to eliminate the suggestion (the true key here also) in their experiments of transfer with the magnet. These subjects are probably not, as they think, oblivious of external influences. In lethargy *e. g.* the subject is impressed with the idea that he cannot or must not react to any stimulus or suggestion, and this state can be excited

artificially, as it were, in all patients in the somnambulistic state. In all the very many cases tried, Bernheim could never produce transfer of sensation, contractures, pains, etc., from one half of the body to the other with magnets without suggestion, but always did it with suggestion without magnets. The same is true of mixtures and complementary effects of imaginary colors, and the doubling of unreal objects by looking through a prism. The color effects are many and there is no doubling with subjects ignorant of these effects, but let them once see they are looking through a prism, or what are the effects of so doing, and what color or mixture effects occur with real images, thenceforth they exhibit all that Binnet and Féré found. Tests with rotating prisms show that the fictive image does not conform to the conditions of real images. Finally he recommends these young experimenters to repeat their experiments on new subjects with new precautions, and predicts they will reach very different conclusions. The tests of Bernheim are certainly far more varied and ingenious.

The chapter on history and literature is concise and full and is brought down to date, and is perhaps the best yet written in its space. The most important chapter is probably that on interpretation. Instead of being so unique and anti-physiological as this state at first seems (C. Bernard said if these facts were true they seemed to necessitate starting over again in physiology), it is largely explicable from the well known facts of reflex action, automatism, and instinct modified by the psychic organ. A man absorbed in thought is functionally decapitated, and like a frog deprived of its hemispheres, has the reflex and mechanical functions exalted. Changes of physiognomy, gestures, inflections, and all indications of emotional play, and perhaps walking, etc., all of which may accompany speech, are both more complex and much more regulated by laws than the conscious processes involved in discourse. When preoccupied we avoid obstacles, react to noises, odors, temperature, react to many incidental stimuli by acts which, though originally free, are so no longer. Intense impressions transform themselves into automatic acts; so, on the other hand, attention need not be long absent for hypnogogic illusions to arise. The faith of the theologians, or *credivité*, is abandonment to authoritative suggestion. It is indispensable for education, business, etc., and we have a first tendency to believe every statement, which credulity must be afterward corrected by a second, induced or native. This is akin to the cerebral docility which obeys all orders. The degrees of authority of the person who suggests, of sleepiness or concentration in the subject, and of native susceptibility, are of course many. Even the normal state presents "psychic decapitation" in a rudimentary degree. Ideas are projected or transformed as sensations.

Bernheim would explain suggestion to be carried out in waking states later, by assuming that impressions produced by artificial sleep, or provoked, are always conscious at the moment when they are produced. This consciousness, although lost on waking, can always be evoked by simple affirmation. These latent souvenirs may revive spontaneously in certain states of psychic concentration. Ideas suggested in sleep to be acted out later do not remain latent or unconscious till the moment appointed for action, as Beaunis and others have said, but may recur repeatedly in the interval. The last part of this book is devoted to the detailed description of 105 cases upon which the therapeutic effects of hypnotism have been tried at Nancy, nearly

all with success. These cases cover a great variety of complaints, mostly with nervous complications. Finally, all physicians are strongly advised to hypnotize no patient without his or her consent, to never do so save in the presence of a third person, and to suggest nothing not essential to therapeutic ends. These rules should be observed as safeguards of the physician's conscience and his professional honor.

Le somnambulisme provoqué, études physiologiques et psychologiques. H. BEAUNIS, professeur de physiologie à la Faculté de Médecine de Nancy. Paris, 1886, 250 pp.

This well known author introduces this work with a chapter of statistics of liability, showing that for the somnambulistic stages, concerning which tables by different observers have been most variable, the liability of the two sexes is about equal. Again, out of 744 hypnotic subjects, 23 were less than 7 years of age, and 59 were over 63 years old. That of the above total, 65 were between the ages of 7 and 14, and 87 between 14 and 21, is also significant for the possible role of hypnotization in education. Subjects were hypnotized with great care to avoid all muscular tension, and were told now that their heart beat more and more slowly, now faster and faster. The heart was made thus to vary between the extremes of 15.4 and 19.2 beats per second, the respiration rhythm remaining constant, all emotional excitement avoided, and the modification following almost immediately upon the suggestion. These observations, with facts like the famous Townsend case, that of Dr. Fothergill and the cases gathered by Tarchanoff, seem to show that in some subjects the will can act directly in retarding and perhaps accelerating the pulse, and suggest therapeutic effects, already found salutary in a few cases, in palpitation and other cardiac neuroses. Like Mabille, Dumontpallier and Focachon, Beaunis believes he has produced circumscribed cutaneous congestion, with local increase of temperature, passing to measurable swelling, and even vesication on the skin (generally of the forearm), by suggestion only. Dynamometric force in most cases (162 in 242) was reduced during provoked sleep. Hypnotic suggestion probably (the experiments are too few here to be conclusive) increases the acuteness of hearing, and reduces the reaction time for both tactile and auditory sensations.

In his interesting chapter on the nature of suggestion, and on spontaneity in the somnambulic state, the author shows himself in the main in accord with the other members of the school of Nancy. The theory of concentrated attention as represented by Braid, Carpenter, and Liebeault, is probably one of the most helpful phrases, but really explains little till we know more about what attention is. The conception of Durand de Gros (Dr. Philips) has the merit of trying to go deeper by suggesting that thought activity is reduced to its simple and isolated elements, so that mental action is suspended save at one point, while the nervous force accumulates to the point of congestion in the brain in general, and can be turned with unusually high pressure on to any organ or mode of action—this displacement by suggestion being termed ideo-plasticity. Beaunis says the primordial fact is the *action of arrest*, which may be either sudden cerebral shock, or gradual. In this state there is little or nothing in the mind which is not suggested immediately through the senses. The style of this book is clearness itself, and the material is well and conveniently grouped.

Du sommeil non naturel, et ses diverses formes. H. BARTH. Paris, 1887, 186 pp.

This thesis contains a valuable bibliography upon hypnotism, which is treated as a proteiform malady of sleep, a common nervous diathesis. It is hereditary, a dynamic equivalent of convulsions in children, hysteria in adolescent girls, of neurasthenia generally, and perhaps of exophthalmic goitre, hypochondria, epilepsy, paralysis, which latter are often found in the ascendant. Pathological sleep may begin in an attack of simple noctambulism, consecutive to violent moral preoccupation, or in childhood in a cataleptic crisis resulting from worms, or later in ecstasy, lethargy, etc., but always must originate in a neuropathic basis. All the maladies of sleep can be artificially produced in hypnotism. A functional debility causes loss of harmony among the nervous faculties so that some centres react abnormally, either by inhibition or dynamogenesis. This dissociation of cerebral functions is greater than in normal sleep. Thus arise those paradoxical states which seem so extraordinary and mysterious. The physiological explanation of these purely nervous facts, which are strictly in accordance with scientific facts, should be far more widely diffused. The effort of Maury, Despine and others to trace certain resemblances between these states and those produced by certain narcotic and anaesthesic substances, with a view to inductions concerning the pathological physiology of morbid sleep, has not been successful.

Les anaesthesies hystériques des muqueuses et des organes des sens, et les zones hysterogènes des muqueuses. L. LICHTWITZ. Paris, 1887, 182 pp.

The author, who dedicates his work to Professor Pitres, is an otologist and laryngologist, and his work is characterized by admirable diligence and scrupulous attention to details. The buccal mucous surfaces, the palate, nasal fossae, larynx, external meatus, tympanum and middle ear, conjunctiva and cornea, and finally organs of taste, smell and hearing were tested. The author finds that in hysterical subjects, anaesthesia of mucous surfaces almost always occurs with dermal anaesthesia, but was never observed to be completely unilateral over all the mucous surfaces. Tympanic sensibility plays no role in auditive orientation. The cartilaginous part of the eustachian tube seems never to be entirely anaesthesic. These tests were made by pressure, pricking and heat. The gustative field is often reduced. Parageusia is most common for sapid substances. Anosmia is more often unilateral, and although usually accompanied by anaesthesia of the adjacent mucous surfaces, seems less closely associated with dermal insensibility than is ageusia. Auditory anaesthesia has no rapport with that of the skin. Again, of eleven hysterical subjects, six had hysterogenic zones on the mucous surfaces. These seemed most common in the naso-pharyngeal region. Those with mucous also have dermal zones, and the former are often bilaterally symmetrical. Although ordinarily constant, these zones sometimes change their nature and appear and disappear quite suddenly. These points have not only high diagnostic significance, but their discovery is of great etiological and therapeutic value in such cases. By testing for such points, accidents in operations may be avoided. Chemical and electrical agents often excite them.

Eléments de médecine suggestive. Dr. J. FONTAN et Dr. CH. LÉGARD. Paris, 1887, 304 pp.

These two professors in the Medical College of Toulon agree substantially with the school of Bernheim—whose great work (above) they call a veritable catechism of suggestive medicine—in assuming that the hypnotic state creates no new functions, but only exaggerates the normal waking function of suggestibility, and hence we hear little of the action of magnets or of neuric forces, or of drugs at a distance. Hypnotism, however, differs, they believe, from normal sleep in that it fatigues, while the latter rests, and in certain ocular phenomena, especially palpebral and sometimes orbital spasms. Charcot's three stages are purely hysterical, but pure hypnotism is better differentiated by three degrees of intensity, with intermediate degrees which are described. Whether hypnotism is functional extinction of the ego, or essentially inhibitory, or a tonic cramp of the attention, loss of will, or hyper-excitation of cerebral cells by reflex changes of cortical circulation, or absence of associative functions, are questions as yet insoluble. It is said that a generation that has a passion for developing suggestibility is declining, but medical science would rob men only of the liberty to suffer. Hypnotization is no more dangerous than the ordinary methods of therapeutics. If hens have been killed by hypnotism, as appears, drugs would have been no less effective. With one apathetic patient with mild delusions, it was enough to suggest, "you will see no more apparitions and talk no more with the wall, will have no more thoughts of suicide, will practice your piano, learn your lessons, and you will will." Suggestion seems to act on every function under the influence of the brain. Painful sensations do not hurt if the idea of pain is not aroused. Suggestibility is reversion to a state which is infantile in being mainly automatic, plus such results of mature experience as have become mostly automatic, but always with irresistible impulsion, whether faintly conscious or not. Even moral orthopedics, at least so far as the correction of unhygienic habits are concerned, is practicable in some cases. It is far easier to inhibit and repress functions than to develop them. Part second of this volume teaches physicians how to apply these methods, and part third states results, followed by 89 cases of cure or great amelioration due to hypnotism, these cases constituting nearly two thirds of the entire volume, and may be thus tabulated:

A. Diseases of the nervous system. 1. Organic affections of the nervous system, apoplexy and consecutive hemiplegia, myelitis, meningitis—6 obs.; 2. Grave neuroses, hysteria, abortive or complete epilepsy—7 obs.; 3. Insanity, alcoholism, hysterical insanity, delirium, imbecility—5 obs.; 4. Palpitations, insomnia, lassitude or neuropathic troubles—8 obs.; 5. Neuralgias, sciatic pains, megrains, and other nervous pains—14 obs.

B. Other diseases. 1. Nervous, muscular, secretory and other troubles due to internal affections, whether hepatic, pelvic, rheumatic or gastro-intestinal—21 obs.; 2. Diseases due to external troubles, such as contusions, urethric inflammation, affections of joints or skin—21 obs.; 3. Fevers, paludism and pyrexias—4 obs.; 4. Chlorosis and menstruation troubles—3 obs.; 5. Surgical anaesthesia—4 obs.

Reflex and painful troubles seem chiefly amenable to this treatment in these cases, all from the practice of the authors in the maritime hospitals at Toulon. There are a few failures, but the ratio is not far from that of Liebeault in the hypnotic treatment of incon-

tinence of urine, viz., in 77 cases eight failures. It is always the suggestion and not the hypnotism that cures in this cerebral orthopedics. Voisin reports a case of mania and another of lypemania favorably modified by hypnotic suggestion, and later three cases of hysterical insanity. This method must henceforth take an honorable rank in therapeutics. Psychologists and alienists will be especially interested in cases VIII—XVI, both inclusive. The work as a whole is serious and purely practical, but we are less convinced of the efficacy of hypnotic suggestion in the class A 1 and in B throughout (above) than of A 2—5, where its efficacy seems well established.

L'hypnotisme et les états analogues au point de vue médico-légal. GILLES DE LA TOURETTE. 1887, 534 pp.

The author of this valuable work was lately an interne in the Salpêtrière, and is now lecturer on legal medicine, and is full of acknowledgments to Charcot and Brouardel. Liebeault reported in 1880 that out of 1014 persons tried, all but 27 were hypnotized. Many signs, such as ready perspiration, habits of unquiet sleep and of dreaming, anaemia, neurotic diathesis, especially hysteria, have been said to indicate those adapted to hypnosis. Of all the hypnotic states, lethargy is the state most favorable to rape, as shown by many criminal cases. Hypnotic education may be in the line of suggested movements, hallucinations, or of acts. Suggestion, which is best in the somnambulic state, becomes more and more irresistible, and the most outrageous crimes can be done by as well as upon the subject. Not only does resistance gradually grow impossible, but even memory of crimes both done or suffered is often irrecoverably lost on waking sometimes, especially if the suggestion that they be so forgotten is made. All this is the more alarming if acts can be suggested mentally without word or sign, as is so often claimed, but which the author deems not proven. Suggested amnesia may be partial and one may recall and perhaps confess a suggested crime and forget the suggestor. Retroactive suggestion may be made in such a way that the subject believes himself to remember acts or crimes committed, or robberies or outrages suffered, which have not occurred. A crime may be suggested to a hypnotized subject to be done hours, days, or even weeks in the future, and the subject then awakened. But at the appointed time the act is spontaneously done, and in some cases entirely forgotten. The problems what is the state of the subject in the interim between the suggestion and the act, and what at the time of the act, are as important for determining the question of responsibility as they are difficult to solve. Natural somnambulism is often one of the first symptoms of hysteria, and somnambulists make excellent hypnotic subjects. If, in the dissociation of senses thus caused, a somnambulist or hypnotic subject falls from a height and is killed, life insurance companies should not interpret it as suicide (which vitiates policies), for it was not intentional. Hypnotism is as valid an exculpation from criminal intent as insanity, although the former on account of its brief duration is more easily simulated. Yet if the subject knows his malady he may be culpable if he takes no precautions and crime is done. Somnambulism is a dream in action, as *e. g.*, in the case of a nun who dreamed the friar of the convent had slain her mother, rose in her sleep, found and stabbed him. These states are nearly always partial sleep, or sleep of the unused senses. Although the degrees of resistance to suggested acts vary greatly with

the subject, the state, the act, mode and force of suggestion, etc., resistance, at least in a subject often hypnotized, can be generally overcome, and even contradictory suggestion accepted with short interval and little objection. Suggestion may even be automatic or self-made. Most cases of supposed death and reanimation are cases of lethargic hypnotism. The second or induced state in cases of dual personality is generally prolonged hysterical somnambulism. Hypnotism is a most valuable agent in the treatment of hysteria in all its forms and complications, and even in hysterical insanity as well as paralyses and cramps. As an anaesthesic agent in surgical cases, despite the great success of Esdaile with 300 cases in the "mesmeric hospital" at Calcutta, and the many amputations, confinements, etc., its efficiency is demonstrated, but chloroform is preferable. "Suggestive medicine" illustrates the power of the imagination, teaches us how truly efficacious relicts and incantations have been, and should be applied with success in certain cases by regular practitioners. Hypnotism is also the best test or revealing agent of hysteria. With such temperaments extreme results may be reached at once, in some cases even suicide. For all crimes and accidents the hypnotizer should be held legally responsible.

One chapter is devoted to quack magnetizers and their advertisements, and argues that travelling exhibitors of the phenomena of hypnotism like Hansen and Donato should be restrained by law, and details many evils arising therefrom. The chief crime due to hypnotism that has thus far come before the law is rape; but as simulation is one of the most characteristic traits of hysteria, it is possible that these may be based on either false or suggested ideas. Finally, an addition to the French code punishing rape in unconscious states is demanded.

This work is on the whole the best thus far written on the forensic aspect of hypnotism. Its material, however, is arranged on no plan, and with very little method, and bears every mark of haste and immaturity.

Étude de la mémoire dans ses rapports avec le sommeil hypnotique. Dr. A. Dichas. Paris, 1887, 122 pp.

This thesis for the degree of Doctor of Medicine at Bordeaux is a brief systematic study of the phenomena of memory that appear in the hypnotic and post-hypnotic states. According to Dr. Dichas, a complete act of memory consists of three principal phases: 1. The reproduction of a previous state of consciousness, *i. e.* an illusion of memory; 2. the rectification of this illusion by a real state of consciousness; 3. the localization in the past. Of these, the first, which necessarily implies the registering and conserving of the original impressions, is the only essential one. In normal memory, "all reduces itself," in the words of M. Taine, "to the creation of an illusion which is immediately contradicted and rectified." In the hypnotic state, on the other hand, the recall of the image, or the illusion, alone occurs, not the rectification. In its place there is an hallucination which finds its explanation in the fact that the automaton alone acts in hypnosis. The author reports many interesting cases of hypnotic subjects observed at the hospital of St. André in Bordeaux. From the study of these and other cases he draws some interesting conclusions. The phenomena of double consciousness are not, as Ribot thinks, to be explained by supposing two memories existing

side by side—the first normal, long organized in the brain of the subject; the other temporary, parasitic, produced by the crisis and lasting only while it lasts. The explanation is rather to be found in the exaltation of the normal memory that occurs in the hypnotic state. Memory is so essential for intellectual activity that the increased power of reproducing impressions may well explain the altered character that the patient displays in the "second state." Dr. Dichas suggests also that, as the memory of the hallucinations of the hypnotic trance may persist in the normal state, while that of ordinary impressions as a rule does not, this fact may account for the numerous confessions by respectable women of incredible crimes reported in the books upon sorcery and witchcraft. The author summarizes his conclusions as follows: 1. During the hypnotic sleep the hypnotized subject remembers events of the waking state and events of previous hypnotic states. 2. In hypnosis, spontaneous or induced, there is often an exaltation of memory. This exaltation can profoundly modify the mind of the subject to such a degree that he no more recognizes himself, and believes in a doubling of his personality. 3. In the hypnotic state disorders, spontaneously or artificially produced, may profoundly modify the function of memory (*Amnésies provoquées, ecmnésie*). 4. After waking, the subject has generally lost the memory of what happened during the hypnotic sleep. But with some patients a simple association of ideas is sufficient to recall what is apparently forgotten. With some subjects, too, all is lost save the memory of hallucinations produced during the hypnotic sleep. This memory, by its persistence in the normal state, may cause serious trouble in the intelligence of the subject. 5. The forgetting of acts done in the hypnotic state is at the discretion of the experimenter, who by a simple suggestion can recall the partial or total memory of them. 6. Acts done in the normal state, or in the hypnotic state under the influence of a verbal suggestion given during the sleep, are subject to the same laws of memory as acts done during hypnosis that are not suggested, *i. e.* after they are performed they are forgotten when the subject is awake, and recalled to memory in subsequent hypnotic states. 7. Suggestion appears to be entirely a phenomenon of unconscious memory. 8. The study of memory, in its relations to hypnotism, enables one better to determine the responsibility of the hypnotic subject. Also, thanks to this study, one can better understand certain facts formerly deemed supernatural. W. H. B.

Sur la polarisation psychique dans la phase somnambulique de l'hypnotisme. BIANCHI and SOMMER. Rev. Philos., Feb. 1887.

The following new experiments still further illustrate what Binet and Féré first called psychic polarization. A pleasure trip on a railroad is suggested to a patient who can only with great difficulty be put in any but the somnambulic stage of hypnotism. On applying a magnet a centimeter from the back of the neck she becomes troubled and thinks of a railway disaster. Many other illustrations are given in which the emotional state and a corresponding image are reversed by a magnet. Emotional states in the somnambulic phase cause oscillations of the galvanometric needle, but this does not occur if the subject is wakened. With each impression the opposite is developed but not attended to. Attention views only one term of pairs of opposites so long as it follows logical or associative laws, but when these are

weakened, as in somnambulism, the opposite of each idea emerges, and thought drops to the stage of contrast or antithesis, and correlative ideas are no longer modified or co-ordinated as in the higher stages of normal life. A magnet even brings out in the somnambulic consciousness a complementary color.

L'anesthésie systématisée et la dissociation des phénomènes psychologiques. PIERRE JANET. Rev. Philos., Mai, 1887.

After reporting an interesting series of experiments illustrating negative hallucination or systematized anaesthesia (where *e. g.* a subject in response to suggestions made in the hypnotic state is unable to see or do certain things on waking), such suggestibility is ascribed to a state of dissociation. Psychic phenomena may be conscious, but leave no trace in memory, because all ordinary associative traces are forgotten. When a subject is unable to see among a dozen cards in her lap all those marked with a cross, containing numbers which are a multiple of three, or certain persons, etc., as a result of hypnotic suggestion, it is not to be explained by assuming unconscious perception. The objects must in a sense be seen in order to be excluded, and it is an error to say that sensation is destroyed. Association springs up, moreover, between the objects thus tabooed from waking consciousness. What are the limits of this dissociation, how many aggregates of states may thus be formed, or better, what are the phenomena that are not thus subdivisible, cannot yet be told.

De la prétendue vielle somnambulique. DELBOEUF. Rev. Philos., Feb. and March, 1887.

Invited by M. Charcot to see some of his more remarkable patients, and allowed to freely test them, M. Delboeuf reached the conclusion that the phenomena, though surprising, were not a tissue of mysteries, but that the mental faculties of subjects in the somnambulic state of sleep, on waking are depressed to the same degree as in normal sleep, and points out many analogies to states he had described in his well known work on sleep and dreams. The sleep walker is monotonous and plays only the tune he is wound up for, or hatches only the egg deposited in his brain by the suggester. Beaunis even says the subject proceeds to the prescribed end with the fatality of a falling stone, but thinks he is free. But yet if the act commanded is a little strange, while it is done all the same, the subject seeks reasons for doing it, and there are sometimes even traces of resistance, and the subject may even feel himself condemned, forced to an act. Beaunis concludes from hypnotic tests that the subjective conviction of freedom in these subjects does, and therefore in us may comport with perfect automatism. But, says Delboeuf, if we are not free we know nothing of the alternative between freedom and necessity. Rather the hypnotizer is free and responsible, and the subject who acts on his suggestion is not.

Das Wesen des Spiritismus vom physikalischen und physiologischen Standpunkte. Dr. HERMANN SPIEGEL. Leipsic, 1888, 70 pp.

The "sympathetic system" is the organ of the "Gemüth." A "spiritist" is one who can excite his sensibility "reflexly from the centre," while common men can do so only from the periphery. He can excite his intellect at will, but not his "Gemüth," and "separates his sen-

sibility from his motility," whence his apparent clairvoyance, which increases as the functions of motion and will decline. This is about the same as occurs in sleep. Thus the spiritist is "an artist of the first rank who plays the role of either an amateur or of a sleeper." The pamphlet has no scientific value or method, but has the mild merit of attempting to turn attention from the realities and so-called facts of spiritualism, to seek the key to it all in the psycho-physiological processes of the "medium."

Le spiritisme. Dr. PAUL GIBIER. Paris, 1887, 398 pp.

This is a historical, critical and experimental study of "occidental fakirism," contains twenty-four cuts and a bibliography, and is devoted more to "experimental spiritualism" than to hypnotism. The author describes the researches of Crooks and Zoellner, raps, spontaneous writing, transportation of bodies without contact, in a way surely hardly worthy a professional naturalist, and concludes with an appeal for a society for investigating "this branch of physiological psychology." Allan, Kardec, Eliphas Levi, Houdin, the fourth dimension of space, cell and plastidute souls, theosophy, mysticism, ancient oracles and magic, comparative religions and theology are the chief centres of interest in this book, which thus illustrates how ineffective is the education which a man now receives in the young author's chosen field to fit him to study with true scientific spirit and method, phenomena in such a field as modern hypnotism opens.

Magnétisme et hypnotisme. Dr. A. CULLERRE. 1887, 358 pp.

This work, here published in a second enlarged edition, contains twenty-eight figures, is a very comprehensive survey of the whole field, historical, psychological, clinical, legal, etc. It is written from no well defined standpoint, but modulates from illustrations of the Rochefort experimenters to the telepathic drawings of the English society for psychic research, and thence to the localization diagrams of Ferrier, with no clear method. The author is evidently a suburban middle-aged general practitioner who has read and quotes extensively.

Le nouvel hypnotisme. L. MOUTIN. Paris, 1887, 220 pp.

This illustrated book, though written by a public exhibitor of twelve years' experience, and of repute not unlike that of Hansen, Das and Donato, has a certain interest to the scientific student of hypnotism. The author is evidently frank in detailing the manipulations and other methods he has found successful with refractory subjects, and even in describing a list of accidents produced in vulnerable subjects by either submitting to or witnessing his hypnotic seances. His drastic methods, the symptoms he relies on, which all evince profound nervous disturbance, the kind of scenes he describes as most effective with audiences, all tend to show that despite the zeal displayed in propagating the cause of "true magnetism," which he says makes for health and science, public performances like his should be suppressed by law.

Der Hypnotismus, mit besonderer Berücksichtigung seiner klinischen und forensischen Bedeutung. Klinische Zeit- und Streitfragen, Band 1, Heft 2. Prof. Dr. HEINRICH OBERSTEINER. Wien, 1887.

This pamphlet presents, under the convenient captions, processes of hypnotization, sensory, motor, vegetative, psychic phenomena, suggestion, physiological explanation, therapeutic and forensic applications, a very concise account, by a well known physiological investigator, of the best results reached in this field by recent studies, and is especially addressed to practical physicians. It is by far the best in its space and ought to be translated into English and placed in the hands of every medical practitioner.

Der Hypnotismus in Frankreich. MAX DESSOIR. Sphinx, March, 1887, pp. 141–160.

This article describes briefly the literature upon the subject during the last few years, and contains the best general bibliography upon the subject yet made.

L'intensité des images mentales. A. BINET. Rev. Philos., May, 1887.

The world of images has its laws and its mechanism. Merely to indicate an idea by way of suggestion is not enough; it must be impressed. It must not only be introduced into the mind of the hypnotized subject, but must be reinforced along the various associative lines of force, for we exteriorize associations as well as single images. Most female subjects have a certain sexual attraction for the magnetizer which may be called "elective sensibility," or "experimental love." Suggestion is really suggestive of form but not color. The tone of voice, direct appeals to attention, increase psychic hyperexcitability and make images intense. Association by resemblance may be intense, and association by contiguity ignored, as *e. g.* in echolalia. Looking at a red disk intensifies the effect of feeble suggestion to hypnotics, making them effective and quickening the memory, and causing in a word the explosion of an idea or act suggested. Peripheral excitation thus corresponds to diffuse, and specific suggestion to localized excitation. So risk often stimulates premeditated crime by giving a stroke of the whip, as it were, to the imagination. Even pressing the eyebrows together, as in voluntary attention, causes psychic dynamogenesis, increases unconscious pressure on the dynamometer, and shortens reaction time. (Cf. Dr. Lombard's article in the November number of this journal on the knee-jerk.) Conversely, all contradictions enfeeble images, and may even expel them; so also does all resistance on the part of the subject, or a suggested image of paralysis. Separation of the eyebrows enfeebles movement and mental imagery. Paralysis may be suggested by association, as where hemiparesis is suggested and aphasia results with it, or where suggested paralysis of a word involves paralysis of the associated image.

Trance State in Inebriety. T. D. CROTHERS. Journal of Nervous and Mental Diseases, Sept. and Oct., 1886.

Dr. Crothers, who is probably the best authority in this country on the psychology of inebriety, adds in this article many interesting facts and inferences to his previous communication on this subject. Sudden partial loss of consciousness of variable duration he believes

to occur in the majority of cases of inebriety when there are no symptoms of intoxication. He may suddenly follow a line of conduct considered but abandoned before, and carry it on with vigor for days or weeks and then stop abruptly, indicating the close of the trance, and go on after with no reference to what he had done. Crimes are sometimes done in this state, with the most conclusive evidence of no memory of it whatever afterward. Even slight drinking often occasions blanks of memory so complete that others must inform the patient what has occurred. One wakes up, as it were, and finds himself in a Turkish bath with no idea of how he came there. This alternative state is perhaps best illustrated in periodic drinkers with long intervals between sprees. All inebriates are bad witnesses as to themselves or their surroundings. The problem of responsibility for crime in such cases is a large field for future study. The relation of these phenomena to epileptic trances, as *e. g.* of the kind lately described by Dr. Hammond to account for mysterious disappearances, and to cases of hypnotic trance, multiple personality, etc., is yet to be traced.

Ueber die therapeutische Verwendung der Hypnose. Dr. RICHARD SCHULZ. Neurologisches Centralblatt, Nov. 1887.

A grave case of hysterical paraplegia, of two years' duration, in a seventeen-year old peasant girl who had been unaffected by other methods of treatment, was almost entirely cured by a few weeks of hypnotic suggestion. This case was studied with indefatigable diligence, and the exact extent of dermal anaesthesia for different tactile stimuli was carefully determined, and its changes shown by convenient illustrations. The same care was also directed to the demarcation of retinal insensibility. The description of the gradual development of the hypnotic state and of its curative effects is interesting in itself, and is made still more so by the fact that Dr. Schulz is himself a good hypnotic subject and gives his own impressions of the subjective nature of the hypnotic state. He inclines to Heidenhain's opinion that the cause of this state is the inhibition of ganglion cells of the cortex, induced by faint but prolonged stimuli of the facial, auditory, or optic nerve. With his patient, he believes the psychic impression that he possessed some marvellous mystic power played the leading therapeutic role. The reason German physicians have been less eager to follow the lines of investigation opened by Charcot and his school at Paris, and by Bernheim, Liebeault and Beaunis of Nancy, is, he thinks, that electricity and the Weir-Mitchell and Playfair-Burkart modes of treatment have been so much more widely used in Germany than in France, and with such good results; but strongly dissents from an opinion expressed by a recent writer, that German medicine should maintain an attitude of coolness toward the entire problem of hypnotism.

Two interesting new cases of hystero-traumatic paralysis in men are reported from Charcot's clinique in *Le Progrès Médical* for Jan. 22, 1887. A waiter, aged twenty-nine, of neuropathic heredity and history, was bruised by a vehicle. He often repeated the details of the accident in the ensuing delirium, but quite differently from the real facts, which seemed to indicate forgetfulness of all that took place at the moment of the accident. He experienced intense cerebral commotion followed by

the traumatic retrograde amnesia of Ribot and Azam. There was increasing immobility of the limbs; absolute anaesthesia of the pharynx such that the finger could be thrust to the epiglottis without the least reaction. Hearing was reduced and the field of vision was obscured concentrically in both eyes. The dermal anaesthesia extended over the entire surface of the lower limbs, save only the entire sole of the right and the anterior half of the sole of the left foot. This mode of limitation of anaesthesia is very different from that produced in organic lesions of the spinal cord, where the insensibility extends over the lower abdominal regions, and is marked off from the normal parts near the umbilicus by a line nearly perpendicular to the axis of the body. The delimitation rather corresponds quite closely, as is shown by plates, to that produced in hypnotized hemianaesthesic subjects when in the somnambulic stage paralysis is suggested on the normal side. The explanation for this case is therefore the following: At the instant of the accident the patient lost consciousness for several hours, and afterwards lay for several days in a state of torpor or obnubilation, propitious for the efficacy of suggestion. "Local shock" left the limbs weak, and the idea of paralysis was auto-suggested, which was aided to vividness by emotional perturbation. It is possible that the idea thus developed was that the limbs were crushed and even removed. *Schreck-lämungenen*, fear-pareses, and the sentiments of feebleness produced by strong emotions probably exhibit parts of the same mechanism or terms of the same series of not yet well ordered phenomena. If this explanation be correct, this case is an illustration of reflex unconscious cerebration where the centre of the diastaltic arc is that part of the cortex representing the centres of voluntary psychic movement, mental unity being thus easily dissociated, so that adjacent regions are unaffected. The fact that the paresis had suddenly vanished in a convulsive attack confirms diagnosis of hysteric symptoms, but the anaesthesia was not reduced.

The second case is that of an athletic man of twenty-five, of imaginative and moody temperament. After a slight contusion on the shoulder he conceived the idea that the entire right arm was removed and a heavy weight hung in its place. Sensibility was reduced in the field of special senses and over the entire dermal surface of the body. Although not hypnotizable, the state of suggestibility is developed by the cerebral disturbance produced by nervous shock.

Note sur l'écriture hystérique. A. BINET. Rev. Philosophique, Jan., 1887.

In the case of hypnotics who write, as they think, conformably to the character of the personality impressed upon them, it is possible that a mental model furnished by memory may have been copied. If so, these cases are of small use to the graphologist who seeks in writing the unconscious expression of character. M. Binet states it as a law that all sensory excitement produced by colors, a magnet, praise, etc., excite in hyperexcitable subjects a general dynamogenesis causing enlarged and often more rapid writing. The character of the sentiment written often instinctively enlarges the script, which in such subjects is soon reduced by fatigue to perhaps even less than its normal size. Excitation and depression are thus directly mirrored.

Ueber die Auto-suggestion bei den Hypnotisirten. N. CYBULSKI. Centralblatt f. Physiologie, No. 12.

Although cases in which hypnotic subjects can send themselves to sleep have been recorded, no special observation of the phenomenon has been made. The author observed that such subjects could hypnotize themselves at any time and entirely independently of the operator. For this purpose the subject has only to imagine for a minute or less that the operator commands him to sleep. The author, without the subject's knowledge, induced a third party (who had no influence on the subject) to propose to the hypnotic that he should imagine that a definite time after awakening he should perform a certain action or have a certain hallucination. Although the subject did not suspect that this proposal originated with the operator, he went through the suggestion in detail. Furthermore, if the subject imagines on going to sleep that he is in rapport with a certain person, even though hypnotized by his operator, he remains indifferent to the latter. From these observations the author concludes: (1). That the rapport between subject and operator is due simply to the fact that the former has the latter in mind when passing into the hypnotic state. (2). That all hypnogenic methods are at bottom only various devices for getting the subject to fix his attention upon a single concept. (3). These observations help to explain such phenomena as hypnotizing through the telephone and certain phases of so-called "telepathy." (4). That results are valid only if the subject in the waking condition had no knowledge of what it is proposed to do with him when hypnotized; if he does know it, any result whatever can be obtained. This explains what has been ascribed to the action of the magnet, and so on. J. J.

Magnetismus und Hypnotismus. Eine Darstellung dieses Gebietes mit besonderer Berücksichtigung der Beziehungen zwischen den mineralischen Magnetismus und dem sogenannten thierischen Magnetismus oder Hypnotismus. G. GASSMANN. 218 pp.

This volume appears in a series of manuals forming an electro-technical library, and the scientific character of its associations gives it a scientific appearance which it far from deserves. The material is indiscriminatingly collected from all sources; an account of a strictly scientific experiment on one page and an utterly incredible sensational (alleged) fact on the next. While denying that the magnet can do all that the mediaeval sorcerers claimed for it, the author yet holds that its influence on the body is underestimated, and that it is "an incontrovertible fact that water undergoes some change by being magnetized with the hand."

The author has invented an improved "hypnoscope" or little magnet, to be applied to the finger, and by the sensations then aroused to furnish a criterion of the hypnotizability of the subject. Two thirds of about 500 persons who tried it experienced certain peculiar sensations, and many of these were more or less ready hypnotic subjects. But the many experiments in which magnets of the greatest strength have been used in such a way as to preclude the action of the subject's imagination, without getting the slightest result, are utterly ignored. In the same way no mention is made of the experiments that show that transfers can be obtained independently of the magnet. The author assumes as a proved fact what is a

matter of extreme doubt, viz. that the magnet has an influence on the human body. He is no less shy in accepting the truth of thought transference, and believes that very sensitive subjects can be made aphasic by looking at the left side of their heads.

The useful portion of the book consists of the historical notes (not always accurate, however; *e. g.*, it is said that Dr. Pigeaire really had a patient who earned the 3000 franc prize for clairvoyance, while the true and usual statement is that this subject refused to conform to the conditions of the Academy of Sciences); of the abstracts of some scientific papers, and the exceptionally numerous and admirable illustrations. In short, the book has an unfortunate pseudo-scientific air, and is much less reliable than some of the recent French compilations on the same subject. J. J.

Experiments in Improving the Condition of Deaf Mutes by Hypnotism. Dr. BERKHAN. Berlin. klin. Wochenschr., 7 Feb., 1887.

Nine boys in a deaf mute institution in Braunchsweig were hypnotized by gazing at a glass button, after their hearing had been carefully tested for a variety of noises. During the hypnosis vowels were spoken into the ears of the patients and other noises made, and they were aroused as soon as possible. The hearing of the boys was tested about half an hour later, and the process was repeated from four to six times on each boy with intervals of a week. The hearing of four of them has very greatly improved, though by no means restored, and at the time of the report the improvement had lasted about eighteen months.

De la suggestion et de ses applications à la pedagogie. Dr. BERILLON. Paris, 1888, 16 pp.

This is a continuation and reinforcement of the writer's paper on the same subject in 1886. The method of putting bad children to sleep so gradually as to awaken no opposition, and by purely verbal suggestion, is first stated. The nature of the suggestion is next discussed. This must be formulated with great precision, after a careful moral diagnosis, and often repeated in a voice and manner at once authoritative and sweet. This is an art of itself, and consists in condensing to laconic brevity the moral needs of the child, with a view also to ready realizability. The child must be alone and not subject to taunts of his fellows for being subjected to the process. A number of new cures of laziness, perverse instincts, grave defects of character, nervous tics, incontinence of urine both by day and by night, menstrual irregularities, chorea and irascibility, are narrated. Bernheim endorsed these conclusions at the end of the paper, and adds that the mother's means of putting her child to sleep are the original hypnotic methods.

Variations de la personnalité. Docteurs H. BOURRU et P. BUROT, professeurs a l'École de Médecine de Rochefort. Paris, 1888, 314 pp.

This book begins with a more detailed study of the case of V... Louis, of multiple personality fame, whose states have been described more briefly by Camuset, du Saulle, Richer, Voisin, Ribot, and F. W. A. Myers of the English society for psychic research. This subject was born in February, 1863, of an hysterical mother and an unknown

father. As a boy he was a vagabond and a thief, and since 1880 had filled a number of servile stations and been a patient in several hospitals, where his hysterical attacks attracted much attention. The six primary states or personalities of this subject are described, with the convenient table of Mr. Meyer showing for each state the extent of the subject's memory, his disposition and education, paralytic and anaesthesic symptoms, dynamism for both hands, etc. Other intermediate states, both spontaneous and provoked, are observed by these authors, who also observe perfect accord between the physical and attendant mental symptoms of each state, and tolerable accord between the successive personations of the same role so far as could be gathered. Each of these states and others are shown by photograph. The last half of the book is occupied by accounts conveniently compiled from many sources of other of the more important subjects of these changes. An abstract of explanatory theories is given in the last chapter, and the authors themselves explain these changes by variations in the focusing and diffusion of latent and potent nervous energy. Therapeutics must learn to distribute this force more evenly, and pedagogy to determine its place and degree of concentration.

Étude sur le zoomagnétisme. A. A. Liébeault. Nancy, 1883, 29 pp.

Forty-five children, most of them under three years of age, suffering from various diseases, each case of which is described in some detail, were cured or helped by the author's touch without pressure. Sometimes the hands were merely laid on, and sometimes the surface of the body was lightly stroked. From these results, which cannot be ascribed to heat or suggestion, the writer concludes that we must admit, along with the theory of suggestion held by the school of Nancy, that the fluidists are also partly right. Nervous vibrations or neurility can thus be transmitted during the waking state from an active to a passive or suffering organism. In his earlier and very important work on sleep, in 1866, the author had held that conscious thought has an equilibrating power which during artificial sleep can be made by suggestion to transport the nervous force of the subject from points of the body where it is abundant to parts where it is deficient or needs excitation. Mental acts thus may diffuse energy from centres where its accumulation causes disorders to centres disordered by defect. With infants, touch redistributes energy and causes an organic calm without mental action. People of energetic, sanguine combustion impress others most strongly. We must admit an irreducible force, *sui generis*, and of great therapeutic power. The motto of this pamphlet is, "He was in the world and the world knew him not." The author's protest against the infallibility of academies, and his bitter words concerning the neglect and scorn often meted out to great discoverers, remind us, in view of the fact that it was his great work, above referred to, which gave its character to the Nancy school, and the theory which he now so sadly lapses from in his old age, of the no less just complaint of Sterling, the originator of the modern idealistic movement in England, of similar want of recognition.

De la suggestion hypnotique, dans ses rapports avec le droit civil et le droit criminel. I. Liègeois. Paris, 1884, 70 pp.

This often cited memoir, by a distinguished jurist, recognizes the unconscious fatality with which hypnotic suggestions are often

enforced, which may render the subject powerless against criminal tentatives. He realizes that souvenirs which are effaced in the waking state may be revived by new hypnotization. Even days after they are suggested to them, hypnotic subjects may commit crime for which they should be held irresponsible, and for which the suggester alone should be punished. Courts should not have power to hypnotize witnesses to obtain from them confessions, or testimony against others. This should apply to all civil acts, wills, etc. If a victim of a crime, or an accused person, however, demands the test of hypnotism for himself, it may be granted under certain specified conditions. It is recognized that to certain persons in a state of apparent waking, suggestions of acts may be effectively given. This, of course, is a point of great importance in criminal practice. No one should be hypnotized save in the presence of witnesses. Hypnotization is the discovery, not the creation, of the capacity of being morally and mentally vivisected. This work contains references to many interesting legal cases.

De l'origine des effets curatifs de l'hypnotisme, étude de psychologie expérimentale. J. DELBOEUF. Paris, 1887, 42 pp.

After visiting the Salpêtrière, and experimenting much himself, this observer, whose admirable work on dreams had qualified him to express an opinion, attempts to explain hypnotism as a therapeutic agent as follows: Commonly, the organism and tissues under the influence of the great sympathetic system of nerves are withdrawn from the action of the will. The hemispheres do not normally interfere with the functions of the non-striated muscles, the vasomotors, glands, etc., or at least if they interfere their role is complicated and obscure. This was not always so. As we descend the animal scale toward protoplasm, organisms were sensibly affected by all that passed within them as well as on their periphery. With the division of work, and the development of the senses charged with expanding external relations with all that could help or mar the integrity of the individual, and other organs of attack, defense, etc., the internal management was committed more and more to a servant which consciousness had trained till it could be trusted to act for itself. The life of relations thus absorbs attention from vegetative functions. In the hypnotic state, however, the subject may violently withdraw from the external world and all his energy is directed to any suggested point. If any internal function has fallen out of order, the higher brain forces can be turned on to it, as an object long neglected but not all unknown, and often with the best curative effects.

Force psychique et suggestion mentale. Dr. CLAUDE PERRONNET. Paris, 1886, 72 pp.

The author, who is a professor of philosophy, holds that the best register of undulations produced in the periphery of the body by the action of thought, is a subject who has been hypnotized and deprived of personal dreams. He would replace the theory of fluidism by that of "undulationism." He has hypnotized 423 patients suffering from nervous diseases, six-sevenths of them women. Of this total number, 288 were essentially improved by mental suggestion. Catalepsy, hysteria, migraine and epilepsy were most often helped, and in this order.

Les suggestions hypnotiques, une lacune dans la loi. F. DELACROIX. Paris, 1887, 47 pp.

The reform for which this magistrate pleads is summed up in the new legal provision he proposes, viz: 1. No one shall practice hypnotism unless he be a duly authorized physician, and be assisted by a second physician especially licensed upon this topic. All public exhibitions of hypnotism, save in schools and laboratories legally chartered, should be forbidden. 2. All infractions of this article shall be punished by imprisonment of from six days to two years, and by a fine of from 16 to 2000 francs, or by one of these alone.

Le magnétisme animal. Dr. F. BOETLY. 2nd ed. 1886, 292 pp.

The author writes in the atmosphere of the Salpêtrière. His book is probably the best presentation of the whole subject in its space, which is much less than that occupied by Binet and Féré. There are slight experimental and critical additions.

Du sommeil provoqué chez les hystériques. Essai d'explication psychologique de ses causes et ses effets. A. ESPINAS. Bordeaux, 1884, 29 pp.

The initial cause of induced sleep in hysterical subjects is the exhaustion of the higher centres by excitation. In normal persons the nervous elements contain a considerable quantity of force *en tension*. In hysterical persons the quantity of this force in each nervous element is small. In the case of normal persons, peripheral excitations which tend to set free the nervous force *en tension* meet with a strong resistance when they reach the higher centres. The higher centres act as centres of arrest by checking the movements which the peripheral excitations would produce if they were permitted to reach the motor centres. In hysterical persons, on the other hand, the excitations which exceed a certain degree of intensity do not meet any resistance from the higher centres in their passage to the ideo-motor centres, and therefore these excitations set free the nervous force in the ideo-motor centres. Thus because of the small quantity of nervous force, the higher centres are easily exhausted and the peripheral excitations are left unobstructed. The exhaustion of the activity of the centres of ideation causes a diminution, if not a suppression, of all sensorial or cutaneous sensibility, and this in turn produces a diminution or suppression of consciousness. According to Professor Espinas, then, that which makes hysterical individuals subject to hypnotism is the weak condition of the higher centres which are easily exhausted, and which diminishes consciousness according to the degree of exhaustion. C. A. O.

After witnessing the hypnotic exhibitions of Señor Das, at the Spanish court, in January of this year, the *Hann. Cour.* reports that Queen Christine is said to have completely hypnotized a young lady of the court who showed remarkable powers of clairvoyance, if the detailed report can be relied on. After rousing the young lady, the Queen asked Señor Das if the power to excite magnetism resided in all persons, and was told that it slumbered in all who had irresistible power of will and perfect concentration of thought. The Queen then desired to be hypnotized, but although the strongest means were tried for some time, the Queen was not only unaffected, but seemed to

show greater power of will than the professor himself. Two German journals, however, report that the experiment succeeded, but one of them expresses the hope that it did not, on account of the grave consequences that might have befallen the country had the Queen really developed this high degree of suggestibility.

We have above attempted to present to our readers a digest of the chief representative books illustrating the different lines of experiment and observations and the different theoretic standpoints lately developed concerning hypnotism. There are other large works and countless smaller ones, besides all the contents of the *Revue de l'Hypnotisme*, edited by Dr. Edgar Berillon, and a growing number of works of French fiction occupied either chiefly or incidentally with multiplex personality, telepathy, transfer, or other spurious or genuine phenomena of hypnotism. In a future number we hope to publish results of a line of research already long under way in the psychophysic rooms of this university, which we believe shed additional light on one important group of these facts. One moral of all this movement is most obvious and impressive, viz. that physicians cannot study these phenomena with safety to their scientific reputation without more training in modern psychology than even the best medical schools either in France or in our own country now afford. To this we shall recur at length later.

III.—EXPERIMENTAL.

Ueber Holmgren's vermeintlichen Nachweis der Elementarempfindungen des Gesichtssinns. E. Hering. Pflüger's Archiv, Vol. 40, p. 1.

Holmgren is supposed to have proved, by some experiments which he described before the Medical Congress in Copenhagen in 1884, that the Young-Helmholtz theory of color sensation is the correct theory. His plan was to throw a very small and sharp image of a very small hole in a metal plate on the retina. If the diameter of the image is smaller than that of a cone, then white light ought to look red, green or violet according as it falls upon one or another of the cones of a cone triad; if it falls half way between two it ought to look purple, yellow or blue, and only when it hits all three equally would it look white. If only saturated yellow light is allowed to come through the hole it may look red or green, but never violet or white. A white hole ought then to look in general colored, and only occasionally white; that is, provided (1) that the theory is true, (2) that a small enough image can be produced, and (3) that in spite of the constant, rapid, involuntary motions of the eye, the different sensations furnished by the different cones can be distinguished in consciousness. Holmgren succeeded in his experiments with homogeneous yellow light from a spectrum. He was less successful with blue light, and he does not seem to have tried white light. Hering criticises his method and, on repeating his experiments, failed to obtain his results.

Holmgren says that after struggling for some time with the difficulty of producing a sufficiently sharp image on the retina, he hit upon the idea of using a telescope, and that this instrument must hereafter be looked upon as an indispensable aid to all experiments of this sort. Hering says that this is surprising; for producing a

small sharp image one should use what Volkmann calls a makroscopic arrangement, that is, the objective of a telescope so arranged that the real, diminished image formed by it may be looked at by the naked eye at the proper distance for distinct vision. Spherical aberration is to be guarded against by a diaphragm with opening smaller than that of the pupil, but not so small as to allow insufficient light to pass through, nor as to let diffraction about the edge interfere with the image. This arrangement is what is always used to determine the fineness of vision of the retina, and to find out how small a colored object must be to lose its color. If a hole 1 mm. big is looked at at a distance of 1 m. its image is already less than the diameter of a cone in the fovea; if it is put at a distance of 5 m. and looked at with a telescope which magnifies five times there would be, theoretically, no change in the size of the image, and hence nothing would be gained by the telescope; but what Hering has called the aberration region (to be distinguished from the dispersion region, due to incorrect accommodation) *might* be greater than without the telescope and with the diaphragm, if the cone of light which enters the eye were greater. But the "bright spot" in front of the telescope is in general smaller than the pupil, and Hering does not say that he makes the aperture in his diaphragm *very much smaller* than the pupil; hence he does not seem to have established that the use of the telescope, with proper precautions, is particularly injurious.

Hering's next criticism is that Holmgren in moving his eye may have allowed now one side and now the other side of his pupil to become covered by the dark part of the telescope. This would lead to a known source of error. If a narrow line of light, formed by one card held parallel to another but several feet in front of it, be looked at with one eye, its borders appear red and blue. This is because the aberration region, which is usually white on account of the superposition of rings of color on one side of the green upon rings of color on the other side of the green, has now half of each set of rings cut off, and hence is blue on one side and red on the other, or, with yellow light, red on one side and green on the other. This objection would be without force if Holmgren had used absolutely homogeneous light, and Hering's next step is to show that he did not take sufficient precautions to that end. An absolutely homogeneous spectral light can be had only if the hole is exactly in the plane of (the image of) the spectrum. With the hole in any other position, rays of different refrangibility can get through, and as they are moving in different directions, a change in the position of the eye will cause the spot to look now of one color and now of another. That yellow should easily become red or green, but that green should not become yellow and blue, is owing to the fact that with a feeble light the yellow and blue of the spectrum are of particularly feeble intensity. A very feeble spectrum looks red, green and violet only, as is well known.

Hering repeated the experiments, using a metal plate with a very thin spot in it, and a conical hole in the centre of the thin spot .09 mm. in diameter at the small end. The plane of the hole was in the plane of the spectrum, and 20 cm. in front of it was a Hartnack objective system with a diaphragm. When the eye, properly guarded from extraneous light, was at the right distance, different for different wave lengths, the calculated size of the image was less than that of a small cone, and sometimes only one fourth as great.

With this arrangement the Holmgren effect was not obtained, but yellow light did become red and green, both with and without a telescope, when the arrangement of the apparatus was inexact. It seems singular that Holmgren did not try the light of sodium in a Bunsen flame. With the sodium, lithium and thallium flame Hering was not able to obtain any change of color at all. He observed, what was known before, that yellow becomes white with diminished intensity, green very rapidly so, and red not at all. He observed also that weak blue points cannot be seen at all by direct vision (on account of absorption by the yellow spot), and that green and white points are strikingly brighter in indirect vision.

Holmgren says that white light might be tried, but that, "*der Kürze wegen,*" he used only spectral light. There are certain points in nature which can be looked at in much shorter time than small holes lighted up by the spectrum,—they are the stars. Even when looked at through the telescope they present no change of color with change of position of the eye: it seems impossible that this should be the case if Holmgren's experiments were to be relied upon.

Hering's argument is not at all skillfully carried out, but nevertheless it seems to be quite conclusive against Holmgren's inferences. It does nothing to *disprove* the Young-Helmholtz theory of color sensation, though it would be very effective against it if it could be shown that the image on the retina had been shorn of its aberration circle. Helmholtz himself has said, however, that there is no reason for supposing that the three different sensations may not be three different activities in one and the same cone, and that the supposition of three cones is kept up merely for the sake of greater facility in speaking about the matter. CHRISTINE LADD-FRANKLIN.

Die Gesetzmässigkeit des Helligkeitscontrastes. H. EBBINGHAUS, Berlin. Sitzber. der K. Preuss. Akad. der Wissensch. zu Berlin, 1887, Sitzung vom 1. December. 15 pp.

To this very difficult topic of experimental psychology Dr. Ebbinghaus, whose study of the laws of memory is deservedly well known, makes a very valuable contribution. He succeeded in preparing a series of papers varying through shades of gray from the whitest white to the blackest black, and was able to get 53 such shades differing by objectively equal differences of brightness. The general tone of the grays was approximated to that produced by the rotation of pure black with pure white. He cut disks 2 cm. in diameter from these various papers, and placing a given disk on a background of its own shade, he found what shade of disk he had to place upon a background of a different degree of brightness in order that the two disks shall seem equally bright. It is evident that the difference in brightness of the two disks measures the amount of contrast. Working with great attention to details and with conditions analogous to those that the eye is subjected to in our every-day vision, he deduced from a large number of experiments the following laws: 1. Disks placed upon a background darker than their own shade of gray have their brightness *increased* by an amount that is closely proportional to the difference in brightness between disk and ground, but is independent of the absolute brightness of the ground. On the average the brightening by contrast is from one quarter to one fifth of the difference between disk and ground. 2. A disk placed upon a darker ground has its brightness *diminished* proportionally to

the difference between disk and ground taken independently of the absolute shade of the ground. In addition the darkening is dependent upon the brightness of the ground, being inversely as the brightness of this ground when the differences between disk and ground are equal. The amount of contrast is .3 of the difference between disk and ground, divided by the brightness of the ground. These laws yield the formulae, (1) $+c = K(h - H)$ where $h > H$, and (2) $-\frac{c}{h} = K'\frac{(h-H)}{H}$ where $h < H$; or $-c = K'(h-H)\frac{h}{H}$; where $+c$ indicates the brightening due to contrast, $-c$ the darkening, h the brightness of the disk, and H that of the background, K, K' constants depending on individuals and conditions. An interesting deduction from the second law is that the darkening by contrast has its maximum effect when the ground has upon it a disk of half its own brightness.

Lehmann had studied the problem of contrast with rotating disks, and Ebbinghaus is able to show that the first law is deducible from the former's results, his constant being .226. Of the second law, however, no trace is to be found in Lehmann's results, which is considered as due to unfavorable conditions of experimentation. By way of explanation of the phenomena the author believes the process to be in the retina itself, and supposes a change in sensitiveness of the different portions of the retina due to slight variations in the blood supply.

The second part of the paper is devoted to a test of Weber's law. If a series of shades be arranged, the ratios forming a geometrical progression, the intervals of brightness will not seem the same throughout the scale, as Weber's law demands, but both at the upper and at the lower ends the intervals will seem too small, while even in the medium portion slight differences can be detected. Conversely, if we arrange a series of shades that, as far as these papers allow us to do, seem equally different (the comparison being made pair by pair), we will not get an exact geometrical series. But if we have in mind only general approximate results we can say that within the limits of black and white, with which we ordinarily have to do, a series of subjectively equal intervals of sensations of brightness has objectively corresponding to it a geometrical series of light intensities. Dividing the field of shades into seven divisions, the ratio for passing from one to the other, from below upwards, was found to be 2.25, 2.11, 2.05, 1.77, 1.72, 1.68, 1.98. J. J.

Ueber die Unterschiedsempfindlichkeit für Tonhöhen. EDWARD LUFT. Philosophische Studien, IV, 4, 1888.

From the fact that we regard tone intervals as equal when the ratio of their vibration rates is the same, Fechner inferred that Weber's law is valid for sensations of musical pitch. The validity of this inference was questioned by Preyer, who suggested that this perception of the equality of intervals might be due to the occurrence of overtones and so on, and furthermore showed that the smallest perceptible difference in the pitch of two tones was not proportional to their vibration rate, but much more nearly approached constancy for all tones of a medium pitch. Luft subjects the results of Preyer and others to a fair and discerning criticism, and makes a series of observations in which care was taken to have the tones equal in intensity, the latter being the point in which Fechner saw the weak-

ness of Preyer's results. A series of tuning-forks of 64, 128, 256, 512, 1024, and 2048 vibrations per second were connected with resonator boxes that could be opened at will; on one prong of the forks was arranged a mechanism by which its tone could be slightly and measurably altered. This consisted of a screw sliding a weight up or down along a millimeter scale. The observation consisted in slightly altering one of the forks of the same vibration rates, and by several slight adjustments, first from below the point of perceptibility to above it and then *vice versa*, to infer the point when the difference was just perceptible, as also the point when the two tones were first declared equal—Wundt's well known modification of the method of "just observable difference." The result can be most briefly expressed by taking the average between the mean determination of the point of "observable difference" and the point of "equality." This is given for Luft himself in the following table:

No. of vibrations,	64	128	256	512	1024	2048
Observable difference,	.149	.159	.232	.251	.218	.362

The first number, for example, indicates that a change of .149 of a vibration per second of a fork vibrating 64 times per second is just perceptible to the ear as a difference in pitch, but, as is true throughout, without an appreciation of the direction (whether higher or lower) of this difference. If Weber's law were true these numbers should be (taking .149 or .15 as the standard) .15, .30, .60, 1.20, 2.40, 4.80. One sees at once that Weber's law does not at all hold, there being a much greater approximation to a constancy (about .2 of a vibration per second) in the just observable difference of tones between 64 and 1024 vibrations per second. Above and below this point the sensibility undoubtedly decreases, but probably not in the ratio demanded by Weber's law. Other points of importance are that the effect of practice is very marked and must first be eliminated; that this effect is decidedly greater with low than with high notes; and that the effect of fatigue is also very evident.

Luft also made some determinations by the method of "right and wrong cases," but the method is so clumsily applied that an inference from the results has little value except to corroborate in a vague way the results already recorded. He thus agrees with Preyer, though the numerical results of the two are not comparable as they stand.

This well designed study suggests comment in two directions. In the first place, granted that Weber's law does not hold for differences of pitch (and this Fechner afterwards practically admitted), how can we explain the acute perception of the equality of tone intervals, and what psychophysic bearing has this perception? In the second place, this study is unsatisfactory because it could so easily have been more valuable. It is an instance of a good observer hampered by a poor method. The object of experimentation is to reduce subjective influences to a minimum, while the method of the "just observable difference" brings them to the front. Not until results obtained in Leipzig can be repeated elsewhere with as great an assurance of reaching the same conclusion as the nature of the experiment warrants, will psychophysics be acknowledged an exact science; and the first step in that direction is the employment of controllable and logically justifiable methods. The methods employed in this research would not pass such a test. J. J.

Ueber den Einfluss einer Sinneserregung auf die übrigen Sinnesempfindungen. VICTOR URBANTSCHITSCH. Pflüger's Archiv f. d. ges. Physiologie, XLII, 3-4, 1888.

The well known cross-associations between the senses, by which, for example, a piercing tone calls up a red color, etc., and of which Bleuler, Lehmann and Mr. Galton have given so able descriptions, suggested to the author an experimental investigation of the influence of a sense impression through one sense upon that through another. In particular he asked if one sense organ is stimulated with the smallest stimulus that will arouse a definite sensation of a certain kind, will the simultaneous excitation of another sense organ have an influence, favorable or otherwise, upon the perception of the first? This question he answers in the affirmative for almost every type of sensation. It will only be necessary to sample his observations here and there, asking the reader to remember that almost any pair of sensations that he selects will have a similar influence to that described.

(1.) Patches of color are seen at a distance at which the color can scarcely be made out; a tuning-fork is sounded and the general result is that colors formerly not visible are brought into the sensory field; as Fechner would state it, the threshold is lowered. Tuning-forks applied to both ears, high-pitched forks, are most influential; and wide individual variations characterize all the results, in some cases even reversing the usual result. The influence upon different colors is also variable. Barely legible print is often read when a sound accompanies the effort. Sounds similarly influence smells, tastes, and touches; the increase of pain by a jarring noise being brought under the last head.

(2.) A sound has its intensity decreased if the eyes be closed, increased if the illumination be brightened. Colors have a strong effect. In one case the ticking of a watch was made more distinct by the sight of red and green, less distinct by that of blue and yellow. The influence of sights upon musical tones is marked and various, the effect being different for high from what it is for low tones. Musically gifted persons show these phenomena best. Another curious phenomenon is the localization of tones in different parts of the person, transversely along the head in one case; and this arrangement, though very different from individual to individual, is remarkably constant in any one case. Sights also affect subjective noises, as the rushing in the ears, and stranger still, the effect of an impression upon one eye influences the sounds in the ear on the same side decidedly more than the other. The rapidity with which these effects arise and die out is also very variable, and some time measurements are noted. The influence of sights upon smell is difficult to detect, but upon taste is marked. Sensations of temperature, as also of pain, are increased by increase of illumination. Complementary colors seem to have a similar influence. The effects of color upon animal development and upon psychic conditions as Geothe suggested are also cited as relevant.

(3.) Smell has very slight reinforcing power over other senses, but is most marked with sounds.

(4.) Taste has greatest influence over colors, but no law is evident.

(5.) The influences of temperature and tactile sensations upon usual ones are very interesting, and especially so is the statement that the stimulation by heat or cold of one skin area decreases the tactile sensibility of another area, while a tactile stimulation has a favorable effect upon a temperature sensation.

Finally the author succeeded in producing the "photisms" or "sound colors," by having the subject look at a gray disk on white paper, and describe the color effects he perceived as different forks were sounded—a very important contribution to the subject. The persons who see colors when they hear sounds, or *vice versa*, are thus only marked examples of a normal physiological reaction of one sense upon another.

While the author has here made an important contribution to an obscure field of research, much corroboration of his results will be necessary before they can stand as final; his special laxity is in regard to objective tests (many of which suggest themselves) of the real nature of these peculiar sensory associations. J. J.

Neue Experimente über den Vorgang der einfachen Reaction auf Sinneseindrücke. LUDWIG LANGE. Wundt's Philos. Studien, IV, 4, pp. 479–511.

The chief contribution of this paper consists in the introduction of a new distinction in the analysis of psychic processes. While various observers have called attention to the fact that the psychic process in a simple reaction time was not always the same, they regarded the differences as mainly due to the effects of practice and normal individual variations, and they sought by taking the average of all reaction times to get a single result true for the average individual. Lange, on the contrary, holds that there are normally two methods of reacting to a simple sensory stimulus, which he distinguishes as "motor" and "sensory." In the "motor" type one does not think of the sense impression, but has the attention focused upon the preparation of the motor reaction; while in the "sensory" type every tendency to get the motion ready is avoided, the attention being directed to the sensory impression entirely; when the impression is received the reaction is to follow as soon as possible. These two types are of course perfectly distinct only in their extreme forms, and can be studied only in individuals of steady and self-possessed mental habits. Lange's object was to study the difference between "sensory" and "motor" reaction times in their extreme types. The sense impression was a sound preceded at a variable but controllable number of seconds by a "signal"; a further condition that seems to have worked admirably was the separation of operator and subject in different rooms and in communication by a telegraphic code. The interval between signal and stimulus was chosen for each individual at from one to three seconds according as seemed favorable to the quickest reactions. For three observers the average time of a reaction of the extreme "motor" type was .125, .137 and .123 second, while for the extreme "sensory" type it was .223, .224 and .230 second. The difference in time between the two is thus nearly .1 second, and the average variation of the several times from their mean is also larger in the "sensory" type. The "motor" is nearer the automatic stage, is probably less subject to individual and other fluctuations, while the "sensory" is nearer the conscious voluntary type of action. Furthermore, the reactions in anticipation of the sense impression never occur with the "sensory" type, but are difficult to avoid in "motor" reactions, because the point on which the attention is fixed tends to get first realized. Again, if a stimulus of an unexpected and totally different kind be given, it will always be reacted

upon by a "motor" subject, and will as regularly not be reacted upon by a person reacting in the "sensory" mode. Of Lange's acute theoretical analysis of these two activities only the main points can be here given.

Taking Wundt's well known scheme of the factors in a simple reaction, he concludes that in the "sensory" reaction with the attention fully on the alert, "apperception" and "perception" fuse into one process, while the "motor" reaction does not contain an apperceptive nor a voluntary factor, but is a psychic reflex in answer to a prepared setting of the voluntary apparatus. Anatomically the former process is in connection with the cerebrum, while reasons are given for associating the latter with the cerebellum.

This distinction of Lange's is very welcome, because it promises to reconcile the results of different observers; those who like Wundt naturally drift into the "sensory" mode of reacting, getting longer times than those who favor the motor type. Furthermore, the enormous effects of practice seem now explicable as the transition from the one mode of reacting to the other. J. J.

Sul Tempo di Percezione dei Colori. Drs. G. Buccola and G. Bordoni-Uffreduzzi. Rivista di Filosofia scientifica, Anno IV, Volume V, fasc. 1°, 1884.

This short paper gives the result of a series of careful experiments by two skilled experimenters upon the reaction time for different colors. They reacted, using the apparatus described by Buccola in his *La Legge del Tempo*, to the flash of a Geissler tube colored by the interposition of a plate of colored glass. They made their experiments from day to day at the same hour in the dark and excluded from the results any reactions that were disturbed by noise. These precautions, together with the skill and practice of the experimenters, give great regularity and consequent weight to their determinations. Red, blue, violet, and green were tested. The shortest average time was found for the last; but as this may have resulted from experimental conditions, it is not used for comparison with the others. Six series of thirty reactions each (fifteen for each observer, we judge) are given for each color. The average of the means of these is as follows:

	B.	BU.
Red,	0.153	0.160
Blue,	0.156	0.164
Violet,	0.161	0.168

In the quick perception of red they agree with Kunkel and with Ott and Prendergast. The authors suggest the advantage of study along the same lines on the evolution of the color sense and the determination of a psychometric spectrum to parallel the thermal, luminous and actinic spectra now distinguished. The subject of color perception is not without a certain practical side, since color figures so largely at present in railway and other signals. E. C. S.

Ueber die Grenzen der Wahrnehmung passiver Bewegungen. Dr. A. Goldscheider. Centralblatt für Physiologie, No. 10.

Dr. A. Goldscheider here contributes a valuable series of observations upon the perception of passive movements. He enclosed the

two terminal joints of the left forefinger in a thick rubber sheath to exclude sensations of pressure, and with the hand well supported, rested the finger in a comfortable position by a system of pulleys and compensating weights. He now determined how slight a movement at the joint brought about by a pull upon the finger (interphalangeal) could be detected. He found for the interphalangeal joint .072, .061 and .056 cm.; for the metacarpo-phalangeal .076, .070 and .057 cm. He found, too, that the rate of motion was an important factor, the above motions being detected only if they were performed within .06 second in the former case or .08 second in the latter. A motion about half the extent of those above recorded was detected if executed within $\frac{1}{40}$ second. It must be noted that the subject is entirely passive, and that the sensations other than those arising from the motion at the joint are practically eliminated.

J. J.

Psychologie mathématique et psychophysique. P. TANNERY. Revue philosophique, Février, 1888.

Under the above heading, M. Tannery, one of the most active critics of the mathematical side of psychophysics, reviews a series of recently issued pamphlets, some of which treat of the philosophic foundations of the concepts that underlie mathematical operations, and the others of the mathematical basis of a psychophysic system. The review of the former is significant as indicating the general appreciation of the intimate relation that exists between the application of philosophical truths to the sciences, and the abstract discussion of these truths to which both the logician and the mathematician contribute. Under the latter point of view, Dr. Elsas's critique of psychophysics, and the review of psychophysical formulae by Köhler in Wundt's *Studien*, form the basis of criticism. Dr. Elsas discusses two fundamental questions: the first, whether Fechner's mathematical formulae are deducible from the observed facts; the second, whether a psychophysic system in Fechner's sense is possible. To both these questions he gives a negative answer. Under the first head he argues that the facts of Weber's law can be expressed by several mathematical formulae, each as good as the other, and yet contradictory among themselves; under the second he considers quantity applicable only to the physiological representative of the sensation, and not to a relation between the physical and the psychical. M. Tannery declares himself in accord with both these positions, though he has other ways of stating them, and is perhaps more ready to expect future experimentation to decide as to the most adequate mathematical statement of psychophysical facts. Köhler's article is a very useful one, because it allows of a survey of the many formulae that have been proposed instead of Fechner's, and inevitably suggests the conviction, as Tannery points out, that the entire topic is obscure by reason of the confusion of distinct questions with one another. Köhler himself accepts the "just observable difference" as a real entity and a unit of measure; and this premise prevents him from recognizing the merit of the work of Delboeuf, a very important contribution to the subject. He lays stress upon the distinction of Wundt between the sensation and the apperception of the same, and perhaps it will be by a firm adherence to this and other distinctions that the mist will be raised from this important part of experimental psychology. A hopeful indication in this direction is furnished by

the fact that almost all of the recent writers upon the topic have freed themselves from the uncritical conceptions that Fechner introduced, and agree in the main upon a general end which the establishment of a psychophysics has in view. J. J.

Die Deutung der psychophysischen Gesetze. Ad. Elsas. Philosophische Monatshefte, XXIV, 3 und 4, 1887.

This article forms part of a controversy regarding the fundamental validity and import of the psychophysic law, which has been raging since the appearance of Fechner's first work in this field, and had busied the founder of psychophysics up to the day of his death. It will hardly be feasible to recount here the many and detailed issues which the author takes with Fechner's theories, but a brief notice of their general features is in place, especially as the attack is directed against the most fundamental parts of Fechner's work, and in fact, if accepted, as it promises to be, will be so entirely subversive of much of Fechner's mathematical deductions that Dr. Elsas acknowledges his trepidation in taking so bold a position. Fechner uses mathematical principles, says the author, not as tools, but as a magic wand by which what is not contained in the facts can be brought out of them, neglecting to remember that mathematical aids can only simplify and arrange what is implicit in the facts as ordinarily stated. Fechner passes from Weber's law, which simply states the dependence of the perceptibility of a difference between sensations upon the ratio of the stimuli that gave rise to them, to the logarithmic form of the law by aid of a comprehensive mathematical theorem ("Hülfsprincip"). Dr. Elsas shows conclusively that this principle is unnecessary, and that its agreement with fact in the application of it made by Fechner must be regarded as accidental. Again, Fechner's deductions start with the assumption that sensations can be summated; this the author refuses to accept, and points to the sensations of tone intervals, in which the summation does not give the effect of the resulting interval, but it requires the product to do so. Once more, the "relational hypothesis," as Fechner terms his exposition of the law, is only one of a number of possible hypotheses that fit the facts quite as well as does Fechner's, and the decisive ground of choice between them depends on considerations of naturalness which Fechner hardly touches upon. Fechner sees in the fact that his formulae take into account the existence of the threshold a valuable proof of their validity; Dr. Elsas shows that other formulae have the same merit, and that the threshold is made mechanically necessary by the physiological adaptations of the organism. In fine, the author holds that Fechner's mathematical deductions are irrelevant, that they lead to a false view of the entire field of psychophysics, and that they neglect to consider the natural, physiological import of the facts which it is the aim of that science to coordinate and systematize.
J. J.

Die Willenshandlung: ein Beitrag zur physiologischen Psychologie. Hugo Münsterberg. Freiburg, 1. B., 1888, 163 pp.

In his preface the author tells us that his first plan in writing a work on the Will was to prepare a general treatise, setting forth in the first part the physiology and pathology of the neuro-muscular system, whose function it is to conduct voluntary movements; in the second, to present the psychology of the will and make connec-

tion with the historic theoretical solutions of the problem; and in the third part, to propound his own theory of the will and indicate the relations of the topic to science and philosophy in general. For various reasons he abandoned this design and decided to publish the present contribution, containing an outline of his own theoretical views. The work reveals this origin in a disjointedness of some of its portions that makes it difficult to read and still more so to résumé.

In the introduction he explains that it is not his object to enter into metaphysical considerations, but to attempt to bring into harmony the various physiological and psychological facts of voluntary action. This he does under three heads. The first section treats of the "voluntary action as a motor process," and carries out with great suggestiveness the view that all action is at bottom of the type of a simple reflex act of greater or less complexity. The difference in complexity is of course enormous, especially so when the reaction follows only after a long interval and indirectly, but the fact that all acts find a place in the scale that begins in the simplest contraction is to him the important one. Closely connected with this point is the prominence of the evolutionary doctrine throughout his treatise. A sensori-motor mechanism is the result of an adaptation to the environment by evolution; the less completely adapted mechanisms failing to survive. This conception of all action as a useful reaction upon the stimulus furnished by the environment is carried all the way up, even to acts where the social factor is uppermost, where action becomes conduct, and forms one of the most interesting portions of the work. "The voluntary action as a phenomenon of consciousness" is the title of the second section of the work. It consists in the main of an analysis of the factors in a voluntary act, bringing to the front the "innervation feeling." This feeling is the important point, and when it is anticipatory the act that arouses it becomes voluntary. An act cannot be voluntary the first time it is performed; to learn how to perform a new combination of movements we must get the feeling of the accomplished result. The third section ("the voluntary action as a conscious motion") considers the various theories of voluntary motion, especially such as are based upon physiological experimentation, and criticises their weaknesses. His own interpretation of the voluntary process is founded upon the sensori-motor nature of all action. No brain-centre can be motor alone or sensory alone, but both at once. The various parts of the brain serve the purposes of various kinds of sensori-motor reactions, differing not only in complexity, but in the nature of their associations.

Dr. Münsterberg's treatment of the will coincides in many points with that recently sketched in an essay by Prof. William James, and it is important not only as a convenient compend of an interesting theoretical chapter of physiological psychology, but also because it suggests leading lines of thought by which the results of experimentation are to be interpreted. J. J.

Ueber das Geruchsvermögen der Krebse. Inaug. Dis. K. MAY. Kiel, 1887.

This is a painstaking attempt to determine the anatomy of the olfactory "hairs" of the crab, the chemical composition of their viscus content, and their physiology, by a pupil of Professor Hensen, whose work on auditory hairs has been so fruitful. His conclusions are that the neural content of these hairs near the end of the anten-

nula reacts, by either molecular change or transposition, to odors, and that the disturbance is carried to the centre by nerve fibrils emerging from these hairs. The sum of the surface of these hairs and the number of nerve elements is very large for the size of the animal. However multifarious the olfactory sensations of the crab, one smell, viz. that of decaying fish, is perceived at great distance in darkness. The nerve fibres which go to each hair, and which end in the ganglion, are seen to divide into many fibrillæ. Each hair is a perceptive element. The simple stimulus affecting each hair is met by many fibrillar sensory elements. Thus on the principle of specific energy olfactory sensation cannot be simple, but composed of mixtures of a number of fundamental sensations. Possibly elemental odors corresponding to each species of olfactory fibre may some time be made out by experiment and analysis. Unities of the first order, Professor Hensen appends, may be the designation of the 40 to 100 hairs, and which might be characterized by their order on the antennula. The single fibrillæ and ganglion cells—about twenty to each hair—may be called unities of the second order. With these latter we must start, assuming that their functions are at least not identical, or else the arrangement would be like that of auditory hairs of crabs, to each of which but one hair and one ganglion cell belong. The three or four fibrils each of tactile hairs give one for the bending of the hair in each direction, while by olfactory hairs the specialization of function represents differences of chemical action. Further, as some fibrils are more central than others, not only quantitative but qualitative differences might arise as odorous substances acted penetratingly or superficially upon the content of the hairs. Different hairs, too, may not only control each other and intensify effects, but, as their nutrition and composition may be different, may afford basis for further differentiation of perceptive analysis. Thus Hensen's theory of assimilating and dissimilating processes does not necessarily apply here.

Ueber die Veränderung der Tastempfindung durch Heilmittel. Inaug. Diss. L. Israel. Würzburg, 1887.

Caustic lime, nitric acid, chlorate of zinc, sulphuric acid, iodine, chlorine, bromine, phenol, mustard, cantharides, croton oil, ether, alcohol, chloroform, morphine, carbolic acid, strychnine, ergot, arsenic, nitrate of amyl, oxalic acid, several aniline dies, aconite, quinine, and other substances in fit solutions were applied to the skin and the resulting sensations noted, and the sensibility in discriminating compass points tested before and after the application. The results cannot be briefly stated, but the work is suggestive. Far more extended studies with each substance are needed to give results of great value. The entire paper occupies but about forty pages, and serves only to suggest further and more detailed work in the same direction, which seems very inviting and very promising both practically and scientifically.

Die Beeinflussung unserer Hauttemperatur durch Amylnitrit. Inaug. Diss. F. Lahnstein. Würzburg.

The inhalation of fumes of nitrate of amyl was found, when measured on a thermoscopic-galvanometric apparatus, to cause an increase of over three degrees C. in the superficial temperature of

the skin. This increase was first and greatest in the head and neck, and decreased downward. If after complete cessation of first effects a second and third inhalation followed, it was found that the latter showed greater increase than the first. The subjective sensation of heat lasted 12 to 15 minutes, but the objective after effects lasted somewhat longer.

Ueber die Ziele und Ergebnisse der experimentellen Psychologie. Vortrag gehalten im academischen philosophischen Verein zu Bonn. Dr. Götz Martius, Privatdocent der Philosophie. Bonn, 1888, 24 pp.

The object of this address is a very practical one. It is to explain the objects of and excite an interest in the study of experimental psychology amongst the members of the University of Bonn, in the hopes of establishing at Bonn a laboratory where the progress of experimental psychology may be advanced. The contents of the address are well suited to its object. In a necessarily hasty manner some of the chief avenues of research that have been opened up by the introduction of the methods of science into the sphere of mental phenomena (psychophysic law, reaction times, rhythm, memory, etc., etc.,) are referred to; and the necessity of a laboratory with special apparatus, and special instructors trained in the methods of the new psychology, is well emphasized. This effort to extend the teaching of experimental psychology throughout all the German universities is an extremely significant one, and it is to be hoped that the appeal of Prof. Lipps and Dr. Martius will soon show a practical result; at the same time serving as an impetus for other universities to follow in its footsteps. J. J.

IV.—ABNORMAL.

Ueber Erinnerungsfälschungen. Emil Krapelin. Arch. f. Psychiatrie, 1886, No. 4; 1887, Nos. 1 and 2.

The author of these three articles prefers the term "falsification of memory" or paramnesia, to Sanders' "illusions of memory," for those cases where present situations or events seem to have been experienced before, and points out their analogy with hallucination and illusion of the senses, when (1) in *simple* cases fancy-pictures arise freely and enter consciousness with a pretense of real reproduction or reminiscence of experience; (2) in *associated* cases the sense of personal experience is called out by analogous present impressions; (3) the present situation seems a photographic reproduction with all its details of a past experience. This is called *identifying falsification of memory.*

I. What is heard, read, or even fancied, like boasting lies of adventure, often becomes confused with reality. This seems the case with the tales of greatness of general paralytics, who become a part of all they have heard, seen, or fancied, and their pseudo-recollections are inseparably mixed with their delusions of greatness. Both at least grow from the same ground and have the same content. Strong hopes and also passions affect the normal man's conception of his present surroundings, and the critical faculty is too enfeebled to distinguish between fact and fancy, even in the present, and still less in memory. Scenes may be pictured so vividly that the consciousness of false-

hood, though present, is too feeble and dim to be effective. In intervals of remission patients wonder that they could have believed their ideas of greatness. There is also a type of maniacal insanity that narrates the most absurd personal experiences with the best of faith. Twelve interesting cases are described. The true and false trains of reminiscence may go side by side, very imperfectly fused, and both be alike subjectively certain. Sometimes falsifications of memory appear like imperative forms and are resisted for a time. They are far more likely to be of the remote than of the immediate past, and are on the whole apt to be vague. They are due not so much to enfeeblement of the critical faculty, or to general weakness of mind, as to special vividness of fancy images, accompanied often with dreamy obnubilation. Sometimes instead of sporadic illusions of memory, the latter are so systematized and real as to control every thought and act, and real events make impressions as fugitive as dream images on awakening, leaving no trace behind. All such falsifications are peculiarly characteristic of paralytic dementia. Sometimes impressions of delirium and hallucination seem recollections, when viewed retrospectively, when they did not seem real at the time. Dreams, especially of sexual adventure and of travels, often seem real. Substitution of this sort is not very generally due to the fact that subjective states are dwelt on or repeated, while objective experience is ever variable, for patients often unfold a train of reminiscence extempore upon any theme, and sometimes cannot repeat the same pseudo-experience twice alike, translocalizations in time being especially common. In one case a delirious boy became the hero of a lately read romance with great consistency and detail after his memory had been weakened by over-study and prostration. Sometimes the same experience is repeated each day, but each time as a fresh experience, with oblivion of all previous narrative.

II. Most common here is confusion of persons, due to remodeling present to fit past impressions. This is favored by defective vision, and especially by fatigue, under the influence of which, even in normal life, new persons and pictures seem old and familiar. If remembered impressions lose their vigor they are distinguished from present impressions only with a certain effort. Difficult as it is to separate the idea of a person from his bodily appearance, it yet sometimes occurs even in dreams that a man's name, with elements of his personality, are joined to totally different physical characteristics. The rupture of such strong bonds of association and the institution of others exerts a far more potent influence than the sensuous memory image. The most striking dissimilarity between two persons has no force against their identification if inner voices, intuitions and revelations proclaim it. Very striking are a few cases in which each striking event soon developed the impression that it had been described to the patient or heard of by him before. One patient reproduced the exact words of a long conversation. Real impressions served as the impulse for the gradual unfoldment of these pseudo-reminiscences.

III. Identifying pseudo-reminiscences is the oldest and best known form. In normal experience this occurs as a result of a moment of fatigue, when our present surroundings seem unreal and sink for an instant to the consistency of memory pictures, and is not often due, as Emminghaus thinks, to the unreality caused by a too rapid flux of thought; nor, as Jensen thinks, to analogy of mood; nor often to the looming up of dreams; nor to real though obscure memory of

facts, as Neumann held, who also thought that often the present situation appeared doubled, as sensuous impression, and as thought at once, as if, as Angel explained, perception and apperception were divorced by fatigue, or the least retarded. Jensen's explanation by disparate action of the two hemispheres is disproved by contralateral hemianopsia and other recently observed phenomena, as van der Kalk has shown. Yet Jensen's view is adopted in Schüle's well known hand-book, and Huppert goes so far as to explain double memory by temporary incongruity of action of the two hemispheres by capillary apoplexy. The other view, first stated by Jensen, that some elements of real experience are involved as a nucleus, to which other elements are imagined, and this whole seems memory when only a part is so, was modified by Sander, Sully, Buccola, Emminghaus, who suggest that dreams vaguely recalled may take the place of this nucleus of experience. Perhaps, also, the reproduction is of vivid fancies from the adolescent period, when fancy is strongest. This sense of full agreement of a present with a supposed past, involving as it does the ego, is often momentary, the sense of identity vanishing with clearer insight. The sense of foreknowing dimly what is to happen, and the psychologic moment attending such experiences, is discussed and further cases are given. These important papers at the same time show the great difficulties of the subject, and give promise of better study and fuller knowledge of it.

De la déviation faciale dans l'hémiplégie hystérique. E. Brissand et P. Marie. Le Progrès Médicale, Jan. and Feb. 1887.

According to Todd and Charcot, hysterical is distinguished from organic hemiplegia by the absence of paralysis of the face. Others have denied this exemption to be of any value as indicating hysterical origin. After passing in review chief symptoms, these authors conclude that there is no objective symptom by which organic can be distinguished from hysteric hemiplegia if the face is left out of account. Facial and lingual deviation in hysteric cases may at first closely resemble paralysis, but is due to contraction of muscles on the same, and not to paralysis of those of the opposite side, and is spasmodic and confined to one lip. This conclusion is illustrated by portraits of two male cases.

Ueber Hysterie bei Kindern. Inaug. Dis. P. Riesenfeld. Kiel, 1887.

This thesis begins with an extensive survey of the literature upon this subject since the thesis of H. Smidt (Strassburg, 1880), the limits of childhood being fixed at menstruation, or, if this be unknown, at 14 years of age. Nineteen new cases are described, including four boys. Heredity, anæmia, exhaustion, and parental indulgence are prominent causes. Moderate hardship and exposure, too, excite somatic resistance, and repress whims and excessive imagination. The imitative instinct of children should be more or less repressed, and sudden anger, grief and fear, and excessive desire to be interesting, should be avoided. It is more simple, sudden in advent and cure, less often associated with whims and moodiness than in adults.

Zur sexuellen Form des Verfolgungswahns. Inaug. Dis. A. Gottlob. Würzburg, 1887.

Five interesting cases of men are told which illustrate the tendency to unreasonable jealousy when from alcohol or other causes

their sexual power begins to decline. Drinkers are especially prone to delusions of persecution, with approaching impotence.

Ueber die psychischen Störungen des Klimakteriums. Inaug. Diss. J. BRÜHL. Würzburg, 1887.

Several new cases are well studied, and the views commonly held are carefully presented. The author takes a too gloomy view of the effects of the menopause upon sanity. Psychoses that originate in the involution period are more likely to be malign than otherwise, and mental alienation of the climacteric constitutes a very dangerous crisis. If predisposition, and especially if incipient disturbance exists, the prognosis is very bad.

Beitrag zur Kenntniss der Inactivitätsatrophie der Muskelfaser. Inaug. Diss. B. STEINERT. Würzburg, 1887.

One day, after section of the motor nerve roots, the cross section of the gastrocnemius and sartorius muscles of the frog, measured with many precautions and in many specimens, was found increased, and also their weight increased. Their dry weight, however, was found to be reduced. The same seemed to be the case with the single muscle fibres. It thus appears that the first stage of atrophy of muscle fibres due to inaction is marked by an imbibition of water, thought to be due to loss of capillary tonicity. After two or three days permanent shrinkage of the muscle begins. The same results were obtained with rabbit muscles.

Fünf Fälle von Tumor Cerebelli. Inaug. Diss. M. SCHOMERUS. Göttingen, 1887.

In a digest of the literature which follows the account of the cases, it appears that out of 204 cases thus far described, but 60 have felt dizziness, which is thought to be so characteristic a symptom of cerebellar disease. Out of 364 cases, 260, or 71 per cent, have suffered from headache; about 49 per cent suffer from nausea; 33 per cent from amblyopia and amaurosis; 4 per cent from astigmatism, and 15 per cent from aphasia. The fact is that the cerebellum can no longer be regarded as exclusively an organ of co-ordination. From tumors topical diagnosis cannot be made on account of intercranial pressure. The cerebellar ataxia, so fully described by Nothnagel as highly characteristic, is often wanting.

Ein Beitrag zur Kenntniss des Paralysis Agitans. Inaug. Diss. E. LANTZIUS-BENINGA. Göttingen, 1887.

Paralysis agitans, shaking palsy, sclerotyrle festinans, or chorea procussiva, is a neurosis without demonstrable anatomical lesion, which Charcot and his pupil Ordenstein have studied with precision, and describe as peculiar tremor of voluntary muscles which ceases in sleep, and progressive weakness of muscles and other attendant symptoms. The right arm is by far most often attacked. Psychic excitement of all sorts increases it, and it often hinders falling to sleep. Fourteen cases are well, but not fully described.

Ein Fall von Aphasie und ein Fall von Aphasie mit Agraphie nach traumatischer Läsion der linken Grosshirn-hemisphäre. Inaug. Dis. TH. HEINEMANN. Würzburg, 1887.

A wood-chopper, aet. 30, and right-handed, received a severe blow on the left side of his head and became completely aphasic and persistently wrote from right to the left. His writing vocabulary was reduced to a few words, but after many efforts for many successive days he could write only "mirror script." This was written fairly well, but attempts to write normally produced only vain movements of the pencil. Slowly, after great labor, he reacquired the power to write normally. At the end of about two months he wrote and spoke about as well as before the injury. This is noteworthy as one of the best cases of "mirror script" in literature.

Vergleichende Uebersicht der Classificationen der Psychosen. Inaug. Dis. A. OEBBECKE. Strassburg, 1886.

This is a convenient conspectus of the more important systems of classifying mental diseases which have been prepared since the time of Esquirol and Griesinger. The methods of classification are themselves classified as unsystematic enumerations of clinical types (Plater, Kraepelin); types based on the course of disease, in which typic, progressive, and atypic are distinguished (Arndt); psychological (Erlenmeyer, Stark, who called all forms hyper or para states, and Keiser, with his receptive, active, and tranquil states) (Heinroth, Richarz, Griesinger); physical-anatomical (Lorry, Groos, Singowitz, and Meynert, who use circulating changes as an important factor); systems resting on the forms of morbid diathesis (Langermann, Jacobi, Morel); etiological (Skae), and with greater freedom of combination (Bucknill and Wille); anthropological, with especial account of the stage of development (Tuke, Schüle, Morselli, Krafft-Ebing); systems based on typical morbid elements (Guislain, Baillarger, Weiss). The individual morbid types introduced by each writer are also adduced.

V.—ANTHROPOLOGICAL.

Genie und Irrsinn, in ihren Beziehungen zum Gesetz, zur Kritik und zur Geschichte. C. LOMBROSO, Professor an der Universität Turin. From the Italian by A. Courth. Nos. 2313 to 2316 of Reclam's "Universal-Bibliothek." Leipzig, 1887. 12mo, 434 pp.

The question of the relations of genius and insanity is not a new one. Apart from the literary references found in ancient as well as modern writers, the French alienists, particularly Moreau de Tours, discussed the topic, giving currency to the notion that genius is a neurosis, diverging in several directions from the normal activity of the mind. Radestock, Sully, and others have reviewed the evidence in favor of this conclusion, aiming to further differentiate the type of genius that is allied to the morbid from the genius that is the product of superior brain activity, while Prof. Dilthey strongly antagonizes this entire conception of the great man. Dr. Lombroso (the author of the classic work upon the psychology of the criminal classes) contributes the most comprehensive study of this question that we possess. His point of view is very definite, holding that

the relation between genius and insanity is a very close and important one. Not only that many great men have been victims of nervous and mental disease, or have been closely related to persons thus deranged, but the very nature of the activity for which the world rewards them is often of an abnormal kind. The overworking of specialized brain centres, kindled into fever heat by an intense emotional strain, and not infrequently excited by artificial stimulants—the products that thus result are divided by a narrow and perhaps imaginary line from the vivid fancies of a deranged mind freed from the logic of fact; and conversely, among asylum inmates the instances of literary efforts of no mean order are numerous. Around this central idea the author clusters a mass of interesting and valuable illustrations, so full of suggestive cases and acute psychological comments that it is difficult to give any adequate account of the varied contents of the work. Instances of derangement in great men, including so noble a list as Comte, Schumann, Tasso, Swift, Lenau, Rousseau, Ampère, are graphically described. One chapter is devoted to the influence of the elements upon great men, and aims to show that the summer months, or rather the opening of the warm season, is most favorable to exalted mental activity, and the same is true of the insane. Another chapter studies the geography of the regions, particularly in Italy, in which an unusual number of great men are born. Here the conclusion, as far as there is one, favors the view that warm climates are productive of genius. The influence of race and environment upon greatness is traced. Genius like insanity is hereditary (unfortunately the latter is much more so than the former), and many of the influences that bring out great men increase the percentage of insanity. On the other side Dr. Lombroso cites case after case of madmen bursting out into poetry, amusing their companions with truly humorous sketches, evolving reformatory plans by no means devoid of sense. And if we turn to the fanatics that have influenced the course of history, many of whom would in our day find a shelter in the asylum, our list is increased in dignity as well as in number. The art of the insane is the subject of a special chapter. Another records the remarkable doings of a class of men whom we would call "cranks," while one of the most interesting chapters tells of the exploits of crazed reformers, almost every one of whom met with great success in attracting followers. Nor is the list of topics yet complete. The appendices trace the distribution of artists in Italy, of savants in France, and suggest more than one interesting educational conclusion. They give extracts from the diaries and other writings of the insane, describe the most notorious criminal insane, of which Guiteau serves as a good type, and include quite a complete collection of human follies. It must not, however, be concluded that Lombroso identifies genius and insanity. He distinctly differentiates them, while pointing out the many ties that bind them together, and shows that a large number of great men were free from all taint of mental impairment, and that the stroke of genius has its peculiar though not easily describable characteristics.

The problem here treated suffers from a lack of method. We are probably dealing with several problems in one, and if, instead of discussing the general relations between genius and insanity, we could apply the aid of statistical analysis, such as Mr. Galton has applied to the study of the heredity of genius, we could perhaps

unravel several of the knots in this intricate problem, and relieve the conclusions of much of their apparent paradoxical character. Be that as it may, Dr. Lombroso's work remains a valuable contribution to the subject, as well for the many facts he brings to bear upon it as for the points of view that he advances. J. J.

The Significance of Sex. JULIUS NELSON. The American Naturalist, Jan., Feb., March, 1887, 71 pp.

This is the first chapter of a detailed study, and presents the cytological aspects of the question. It is abundantly illustrated with karyokinetic diagrams, and has a pretty full bibliographical appendix. Sex is considered a secondary or evolved characteristic which we distinguish in the higher organisms, calling that female which produces ova, and that male which produces the spermatozoa. The reproductive cells are of one brotherhood with the other cells of the body, but are specialized in such a way that two cells from diverse individuals may fuse into one cell, which then, multiplying itself by division, builds up an organism like the parent. The offspring are sometimes not only differentiated dimorphically into the sexes, but polymorphically, as in hydroids. Many forms develop from cells that have not been fertilized; the ova of parasites are frequently parthenogenetic, and in low forms even male parthenogenesis has been observed. Still lower, the gametal cells are so similar as not to be distinguished sexually in their conjugation; and sexual generation is the exception in the lowest forms of life.

In the cell there is a substance known as *chromatin*, from its affinity for stains, which is most abundant in the nucleus, where it occurs as one or more spherical bodies, an intricately coiled filament, or as a network with coarser or finer meshes. When the cell divides, the chromatin passes through a cycle of transformations (karyokinesis), which shows that it is a very important substance. This conclusion is fully justified by all that we learn about chromatin in the different aspects of cell life. All cells while growing and multiplying possess it, and if deprived of it lose the power to regenerate lost parts. The yolk of eggs and the secretions of glands, and probably ordinary cell protoplasm, are mainly metamorphosed chromatin. In sexual fertilization, the essential phenomenon is the union of two pronuclei, one containing the chromatin of the ovum, the other that of the spermatozoan; hence the chromatin must carry the hereditary characters, and therefore has been termed the *idioplasm*. (This word implies a psychological property, the full explanation of which requires an extended article to present.) The fundamental significance of sex is therefore involved in the questions, *Why are idioplasms from two individuals of a species blended when reproduction of higher forms has place, and how are these idioplasms structurally related?* The answers are deferred until a general discussion of the theory of heredity is taken up, but provisional statements are made to the effect that a union of diverse experiences, which broadens the cell education, must be advantageous in the struggle for existence. It is assumed that the idioplasm consists of an aggregation of *similar gemmules*, each of which can reproduce itself and whose progeny can build up an organism with its characters. These characters depend on the way in which the gemmules differentiate in building up the cell in the diverse forms obtaining in a complex organism whose unity is a reflex of the gemmule unit. J. N.

La criminalité comparée. G. TARDE. Paris, 1886.

The classical head, with its rectilinear nose, small mouth, moderate jaw, and ear close to the temple, is the exact opposite to the criminal type. Ugliness, if not monstrosity, characterizes the criminal face. That of the assassin is dull, cold, fixed, and that of the thief is oblique, wandering, restless. The criminal rarely blushes, is quite likely color-blind and strabismic, but sees to a great distance; is often ambidextrous and insensible to pain and cold, and can imitate well but cannot invent. The stability of a future civilization once firmly fixed in mental forms will be secured by expelling all kinds of crime from more and more of the great centres so it can enter only as inoculation from without, till after long wars and revolutions the purification will be complete and all men will exist in one truly civilized state, in which scientific truth will be held with such conviction that to know and bear witness to it will be the greatest good and not to know it the greatest evil.

Des attentats à la pudeur sur les petites filles. P. BERNARD. Thèse de Lyon, 1886.

Men guilty of rape are usually of ripe age, quite commonly widowers and often old men, the age of the violator being inversely as that of the victim. These crimes are most numerous in June and least so in November, and are most common in years of abundance. There seems to be a periodic augmentation of crimes of this nature. The mental state of the violators is but little discussed, and the alleged partial precocity of the victims, such as brilliancy of eyes as contrasted with the puerile aspect of the lower part of the face, etc., is hardly touched upon. In the second part of his treatise M. Bernard gives anatomical and other reasons for the conclusion that in these crimes normal vaginal intromission is rare.

Die physischen Bedingungen des Bewusstseins. ALEXANDER HERZEN. 1886.

The physical basis of consciousness rests on the biological law that the activity of a tissue is conditioned by its decomposition, and that regeneration immediately follows. Thus the intensity of consciousness as a function of neural tissue rests on the intensity of this decomposition, and is inversely as the ease and rapidity with which the inner work of one nerve element is transmitted to another, whether motor, sensory, or central. This is experimentally demonstrable by the greater development of heat by vivid conscious processes and the reduced heat attending automatic and instinctive acts. Thus tested, the spinal cord has an elementary unintelligent consciousness, most distinct in lower animals; the centres of sense and motion manifest the dawn of intelligence; the cortical centres show conscious intellect and will. This view, Buccola suggested, was illustrated most clearly in mania, where disintegration is widely diffused and transition to adjacent elements rapid but with feeble intensity, and also in hypermania and stupor, which are characterized by great intensity and slowness of transition. According to Herzen, the ego rests on conaesthesia and somatic sensations, and its continuity and unity, both very relative, are exclusively matters of memory. The psyche is thus represented as an expression of the physical ego; its unity is never complete, but is most nearly so the

more definite and constant the character is, and the greater the harmony between the moral conceptions and conduct.

Les phénomènes affectifs et les lois de leur apparition. Fr. Paulhan. 1887.

Consciousness is an incidental accompaniment of physiological processes which can all be reduced to reflex action. All problems of psychology are at bottom problems of physiology, the psychic process being the sign and the physiological change being the thing signified. Consciousness shows that the machine is a little out of order, or indicates an incomplete organization of a tendency. Pleasure measures increase in the completeness of organization, pain a decrease. The entire monograph is a speculative attempt to apply and work out these principles.

Die wissenschaftliche Charakter der Ethnologie. T. Achelis. Zeitschrift für Völkerpsychologie, Jan. 1887.

After long irregularity and at last practical suspension, this journal is now to be congratulated on beginning its seventeenth volume in new dress, with a new publisher, who proposes to pay a regular price for all accepted publications. The present article begins with the assumption of Ree that philosophy is now in a provisional stage. It stands for the sum of erroneous attempts to explain the facts in its field. Philosophy is now only history of philosophy. When the work of the new psychology is once well under way, hand-books of philosophy will be no more historical than a hand-book of physics now is. Experimental, introspective and speculative psychology are all more or less individual and limited in their scope. Inductive ethnology, which attempts to show the lines along which modern ideas, institutions and beliefs have developed, exhibits man in social relations. The day of subjective existence of the ego, of the theory of knowledge, has gone by, and with it all conceptions of a transcendental world of reason or spirits. Our psychophysic organism, which compels us to see all things double, as mechanical and psychic, is all that is left. In it are all the secrets of the world, and we shall never know it till we have studied and can explain the history of our consciousness. This is best to be learned in the field and by the methods of comparative ethnology, which will give us in the end the most objective view of the world attainable.

Religionsphilosophie auf modern-wissenschaftlicher Grundlage. Mit einem Vorwort von Julius Baumann. 1886. 230 pp.

All religion is an illusion, yet brings joy and blessing to all mankind. Lotze was right that the being of God cannot be proven. That God is the inner force of things means, interpreted according to the psychism of Feuerbach, which the author adopts, that the connections of things always call up the thought of an unitary power. That the finite cannot satisfy, and that God is the abiding good, means satisfaction is sure only when its conditions are internal. In the forms of exact science, religion is only subjective. We project and objectify by our inner experience into images of things divine. Man must not know this great secret that religious realities, not only in the field of Christianity but of the other great ethnic faiths, are subjective, for he must have a wide domain in which he can freely

idealize, and needs to this end art, poetry, superstition, and also true religion. As men believe in the curative power of bread pills, or as the robber thinks the empty pistol is loaded, and the end is secured, so faith in deities is salutary; but it is so in a far deeper sense, for here faith is being, reality. As man feels himself more worthy, his feeling of the dignity of deity increases. The non-ego out of which we arise must somehow have an egoity in it as cause of finite egos. The same is true of belief in immortality which is a remnant of idealism, which modern science or positivism, which eliminates all not an object of sensation, has destroyed. This book, it will thus be seen, is almost exactly in the line of Feuerbach, but far less able.

Die Seele indischer und hellenischer Philosophie in den Gespenstern moderner Geisterscherei. ADOLPH BASTIAN. Berlin, 1886.

The first impression made by this, as by others of the author's works, is confusing. Quotations from great men of all lands and in many languages stand beside the wisdom of Indian chiefs or African magic priests, with no very apparent order or end till the vast method and plan of the author, by which his amazing industry has been animated for so many years, is gradually understood. This is nothing less than to collect all the original and peculiar thoughts of all men everywhere, and to heroically renounce all system-making till these extensive data are mostly in. Meanwhile the latter will be gradually shooting together in a natural order, as by a kind of chemical affinity, and we shall then have a real phenomenology of the human mind. Only when this genetic-comparative method has done its work can the highest of all methods of finding the truth, the speculative, begin. The dream of Hugo, St. Victor and Hegel of a history of consciousness can be realized on a no less broad basis. Such a system of philosophy and religion will rest on the narrow, shallow foundation of acuminated individual subjective thought, but will really consist of what is held to by all, always and everywhere.

This ideal invests even outlandish ideas of remote savage races with deep interest, inspired the long study of Buddhism made with the aid of personal intercourse with the pundits of Siam and Birmah, the results of which are presented in the author's works on the "Psychology of Buddhism" and his "Philosophy of Religion," and has made absence of system in his works cultivated as a virtue, because he holds that the true relation of these ideas to each other can only be found when they are all inductively gathered. The object of the present work is to show that modern spiritualistic and theosophic ideas are bequests of undeveloped savage races to the world of modern culture. As Jäger's idea of soul as something which is smelled is met with among many savage races (even animals whose sense of smell takes the place of sight in man perhaps believing in olfactory ghosts, Marville claiming to see in a magnifying glass that the exhalations of friends fused and those of enemies mutually repelled each other), so theosophy is but a recrudescence of a belief widely proclaimed in the twelfth century and held to in some form by many barbaric tribes. Spiritism and "esoteric Buddhism" illustrate the oldest and most widespread of popular superstitions against which Aristotle so vigorously protested, that the soul is something material, apprehensible to vision, smell, taste, touch, or audition, though finer and perhaps smaller than the body.

NOTES.

In an article on methods of investigation in psychology, in *Humboldt*, Jan., 1888, Professor Kraepelin, of Dorpat, expresses the opinion that the reason why the reign of law has been doubted in the realm of mind is found in wrong views about the nature of the freedom and spontaneity of the will. The idea was that the soul was a somatic attendant apart from the body which attention could observe as correctly at least as it can objects. From the very nature of attention, however, as now conceived, we can observe no psychic process or state of ourselves without a constant error. This latter is partially avoided by the memory method, which consists of turning the mind back upon the remembered image of a recent process. This is a more valuable method. Yet the memory image is always changed, lacks objective control, and so results vary with different individuals. This lack has been supplied by the experimental method, which arose in the field of physiology, but has already unfolded a wide field and numerous methods peculiar to itself. Experiment frees us from the deception of self-perception, and, beginning with the study of the simplest psychic processes of sense perception, is already grappling with the more central problems of attention, fatigue, habit, contrast, reproduction, association, morbid processes, and is even beginning to reach results about feeling and will of general validity like facts of other sciences. Those competent for self-analysis by older methods are so few and so peculiar that only the small part of the field representing certain coincident peculiarities has been worked over, and that only roughly, for exigencies of conduct, etc. The field of experimental psychology is far wider already, and what has been done is very little compared with what is to be expected in the future.

In viewing the well known stair figure of Schröder there is also an oscillation, and we seem now to be looking up under and now down upon the steps. The time of this oscillation was also found to be about the same as that for faint optical impressions above. In all such flickers of apprehension from concave to convex the real sensation does not change, but the "apperceptive organ," or, as Lange calls it, the memory image of previously seen stairs from above and below does. In assimilating the sensation the memory picture intensifies it. This act of active appropriation, according to the laws of association, or the mentalization of sensations, is what is called sensuous impression, and it is the memory pictures that vacillate. The vacillation time of memory pictures was also registered and found to agree with that of real sensation, being only a fraction of a second shorter for each sense. Active apperception, which intensifies impression, is possible only through voluntary motion. Concepts have a motor "hook" or else they cannot be pulled forth by active attention. The phenomenon of mental suggestion shows the existence of a motor element in memory pictures. In thinking of

an object of definite form with eyes closed, the eye-ball often moves, and Loeb has pointed out that the change of a concave image to a convex, and conversely, may be caused by accommodation. Acoustic images, too, are closely associated with tensions in the vocal apparatus. Thus probably we analyze the component parts of a note. Wolfe found tone memory was best after a period about equivalent to one wave of attention, and not, as we should *à priori* expect, immediately. The explanation of the relation between Lange's period and the period of most accurate reproduction of time intervals (.7 second), as determined by Estel and Mehner, is a very poor attempt to meet one of the gravest difficulties of his speculation.

A. Charpentier (*Centralblatt für Physiologie*, No. 2) has conducted a series of experiments upon the relation between the duration of very short retinal sensations and the minimum of illumination at which a sensation of light takes place. He corroborates the law announced by Bloch, that the minimum of illumination that is perceived by the eye is inversely proportional to the duration of the light impression; in other words, a very brief light impression must be proportionately intense to be perceived. A certain light mass (considered as the product of duration by intensity) is necessary for a light sensation, and the two components may have any values, the law strictly holding only for light impressions of less than one-eighth second. Charpentier also found that after remaining in a dark room the sensibility was increased, and that the color of those very rapid impressions (.006–.040 sec.) could not be perceived. In a second portion of the research he pierced holes in a rotating disk and measured the rate of rotation at which a continuous band of light was visible through the holes, as conditioned by the waning (Fortdauer) of the impressions. He concludes (1) that as the illumination increases the waning of the light sensation decreases; (2) that for weak illuminations and brief stimulations the waning of the sensation is nearly inversely as the square root of the illumination; (3) the waning of the sensation varies in an inverse sense with the duration of the stimulation; (4) the color of the light has no effect except as varying the illumination; (5) exposing the eye to a dark room acts like other causes of an increase in the sensation, in shortening the time during which the sensation retaining its initial intensity persists after the cessation of the stimulus. Bloch found that fatigue of the retina increased the time of waning of the sensation, but Charpentier finds a shortening of the time. J. J.

Dr. R. Berlin (*Centralblatt für Physiologie*, No. 2) describes under the name "dyslexia," a novel psychic affection related to "alexia," or word-blindness, but differing from it in that the patients can read a few lines, but apparently get no sense from their reading and give it up in despair. A number of post-mortem examinations of such cases locates the injury in the left hemisphere, and suggests the possibility of a lesion interfering with the function of the fibres connecting the articulation-centres in the inferior frontal convolution with the visual centres of the occipital lobe.

Dr. A. Nieden (*ibid.*) contributes a corrobatory case to Dr. Berlin's description of this "reading phobia." The symptoms developed in the patient subsequent to his first epileptic seizure, and consisted in an undefined aversion to reading more than a line or two. An

attempt to force him to read resulted in fainting fits, with perverse olfactory sensations. There were found three foci of degeneration in the lenticular-striate region, the second of which, lying in the subcortical fibres behind Broca's convolution, seems to be in connection with the above described symptoms.

An interesting test of the function of the feelers of insects has been made by offering the choice of two troughs as a highway to a number of roaches (küchenschaben), one of the troughs having been made redolent of stale cheese (very offensive to the roaches), and counting the number of individuals going over the two routes. Of thirty-six trials the odorous trough was decidedly avoided thirty times, the experiments being made in the dark. If, however, the feelers be cut off from the insects, about as many choose the odorous as the non-odorous trough, indicating that the feelers function as organs of smell. (Veit Graber in *Centralblatt für Physiologie*, No. 6.)

O. Tumlitz describes a simple method of demonstrating the chromatic aberration of the eye (*Centralblatt für Physiologie*, No. 8). A ring of platinum wire about 20 mm. in diameter is brought to white heat and viewed at about half a meter distance, through a minute hole in a screen that just allows the ring to be seen. The outer edge of the ring will then seem red, the inner bluish violet.

Vintschgau and Steinach (*Pflüger's Archiv*) have measured the reaction times for temperature from various parts of the skin. The mere feeling of contact is perceived considerably before the sensation of heat or cold, and on the forehead was perceived by Vintschgau in .119, and by Steinach in .107, second; on the right cheek in .119 and .101 second respectively; on the volar and dorsal surface of the left hand, .126 and .128 and .133 and .111 second. The results of their experiments with the time it takes to perceive heat and cold are given in the following table:

	Cold.		Heat.	
	Vintschgau. 2.2°-4.8° C.	Steinach. 2°-2.8° C.	Vintschgau. 48°-49° C.	Steinach. 45°-49° C.
Right temple,	.160	.116	.166	.132
Left temple,	.170	.124	.185	.138
Middle of forehead,	.143	.116	.144	.128
Right cheek,	.143	.114	.154	.117
Left cheek,	.151	.116	.158	.146
Volar surface of hand,				
(1) 2nd finger-joint,	.186	.152	.205	.173
(2) Near the ulnar aspect,	.206	.186	.208	.206
(3) On the ball of the thumb,	.185	.194	.251	.175
Dorsal surface of hand,				
(1) Near the ulnar aspect,	.208	.179	.246	.199
(2) Near the radial aspect,	.204	.170	.233	.196

These times show that the reaction to cold is somewhat quicker than to heat. Again, it was observed that if the stimulation be applied repeatedly to the same spot at short intervals, the reaction time is lengthened both for cold and for heat, though upon the cheek there was a lengthening of the time for cold but not for heat. Details are promised in a future paper.

Dr. Goldscheider (*Archiv für Anat. und Phys.* V) has been experimenting in the same direction. He applies a metal ball 15° C. for the cold stimulation and 50° C. for the warm, and reacts by a simple movement of the jaw. More than 2000 observations were recorded. The final averages in seconds are: for *cold*, near the edge of the eyelid, .135; on upper arm, .150; on abdominal surface, .226; on inner surface of thigh, .255. Corresponding times for the reaction to a sensation of warmth were: .190, .270, .620, .790. Here heat is considerably more slowly perceived than cold, and the difference is the greater the further removed the part of the skin is from the brain, amounting in the lower limbs to nearly half a second. If the stimulus is weak the time is much lengthened. A moderately warm stimulus on the arm was not reacted upon until after .46 to .54 second, and if very weak, .90 to 1.1 second. Care was taken to select equally sensitive spots in the various parts of the body, and this makes the explanation of the great difference between a stimulation far from and near to the brain still more difficult. The author offers no explanation, but does not accept the explanation that the sensation of heat passes slowly along the gray columns of the cord.

J. J.

Dr. Stanford E. Chaillé, of the Tulane University, gives in a summary article (*New Orleans Medical and Surgical Journal*, June, 1887) the typical stages of development of the infant, the reflexes, the senses, emotions, language, color, and especially the physical measurements. The child, he concludes, is not more pure and virtuous than adults, as is commonly supposed, but manifests in germ most of the bad traits of savagery. Goodness he regards not as innate, but the slow recent result of growth in age and civilization.

In the extended literature now accumulating on the opium habit, it is evident that at least dogs and apes not only fall victims to the habit, but are affected in a way very similar to man by the drug.

Bloch has experimented on the relative strength of sensations as inferred by the order in which two simultaneous sensations reach consciousness, and concludes that it takes $\frac{1}{7}$ of a second longer to hear a sound than to see a light, and that it takes $\frac{1}{21}$ of a second longer to feel a touch than to see a light. Thus the order of precedence in attracting attention would be sight, hearing, touch.

An interesting addition to the material collected in W. G. Black's *Folk-medicine* is made in Mr. James Mooney's paper on the "Medical Mythology of Ireland," where we are told the superstitions described are living realities.

Messrs. E. H. S. Bailey and E. L. Nichols (*Science*, March 23) give an account of some interesting determinations of the sensibility of the sense of taste for the different classes of tastes. The method consisted in having dilute solutions of various strengths, and containing quinine if bitter was to be aroused, cane sugar for sweet, sulphuric acid for acid, sodium bicarbonate for alkaline, and sodium chloride for saline, and in requiring the person tested to arrange these substances according to their taste. Their results, founded upon the observation of 128 persons, 82 male and 46 female, are expressed in the following table:

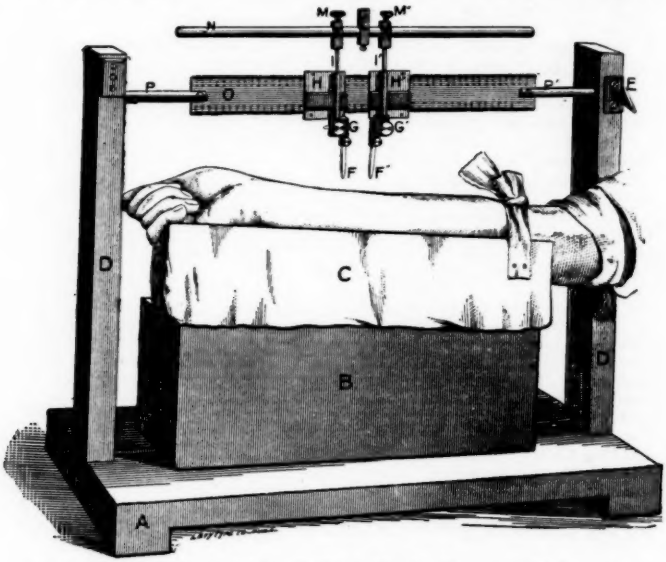
Substances.	Male observers detected	Female observers detected
Quinine	One part in 392 000	One part in 456 000
Sugar	" " 199	" " 204
Acid	" " 2 080	" " 3 280
Soda	" " 98	" " 126
Salt	" " 2 240	" " 1 980

From this they conclude that (1) the sense for bitter is vastly more delicate than for any other class, it being possible to detect quinine in a solution only $\frac{1}{200}$ the strength that a sugar solution must have to be tasted; (2) that the order of delicacy is bitter, acid, salt, sugar, and alkali; and (3) that the sense of taste is more delicate in women than in men. This last is peculiar, because these experimenters had previously shown the sense of smell to be more delicate in men. They also note that wide individual differences presented themselves (as much as in the ratio of one to three), and that these variations were not explicable as results of education, men with great experience in handling drugs being surpassed by women without any such training. In a few cases the ability to detect a dilute sweet was accompanied by an inability to detect dilute bitter. J. J.

Dr. Wm. Noyes, in the *Journal of Social Science*, 1888, 1, gives a very convenient summary of the modern view of the criminal, following in the main the ideas of Lombroso. The distinction of the criminal from his normal fellow-men by physical and psychical abnormalities, many of which indicate a reversion to a more primitive type, forms the chief point in the address. So little of this Italian movement has been presented in English that the above paper is especially welcome.

The Collége de France has just transformed the chair of "The Law of Nature and of Nations" into a chair of "Experimental Psychology," and has called M. Th. Ribot, editor of the *Revue Philosophique* and a well known popular writer upon psychological topics, to the chair. In an article occasioned by this action, M. Janet (*Rev. de Deux Mondes*, April 1, 1888) surveys the various lines of interest that the new psychology embraces. It is wider than physiological psychology and includes the consideration of the morbid manifestations of mind, the minds of the lower animals, of children, and of savages. It is experimental and comparative in its methods, and aims to create a psychology that is abreast of modern science and does justice to all the various phases of the topic. He refutes the notion that the new science is not ready to be taught, as well as the notion that it is "materialistic" in its tendencies. The representatives of the scientific movement have not claimed that theirs is the only aspect of philosophic problems; they have as a rule held the very opposite of materialistic notions, and they are characterized by a spirit of good will and co-operation towards all workers in the field that was lamentably absent from philosophic discussions in the past. M. Ribot in his opening address takes a survey of the activity in matters psychological in the chief European countries and in America, and is able to draw a very hopeful picture indeed. Everywhere is the scientific method being introduced, facts preferred to speculations, and contributions to one or other of the many rubrics of psychology made. Psychological laboratories are spreading, and the day seems not far distant when this science will take recognized place on the curricula of all institutions for the higher education.

The accompanying cut illustrates a new aesthesiometer designed by Dr. Joseph Jastrow, of the Johns Hopkins University. The essential parts of the instrument are as follows: A base, *A*, to which is



attached a pair of uprights, *D D'*; a block, *B*, upon which rests a frame, *C*, for receiving the arm which is held in position by grasping the band as shown in the cut. A fine millimeter-scale, *O*, with two arms, *P P'*, through which it is fastened at *E* at any desired angle. Upon this scale are two carriages, *H H'*, sliding along it with as much or as little friction as is desired. At *G* there is a small "knee" that can be firmly screwed and holds the points, etc., *F F'*; any number and size of these knees can be made. Above are two rods, *I I'*, connected with two head pieces, *K K'*, through which passes a steel rod, *N*. The carriage is held in a fixed position by screwing down the screws at *M M'*, and the two points are made to touch the skin by pressing the button at *L*, which presses down a spring that in turn releases the points. The stand and accessory appliances are of wood, the rest of brass and steel. The length of the scale *O* is 30 decimeters. The instrument is intended to supplant the use of the compass-points held in the hand, and by the numerous variations of the points, etc., allows of a more convenient and accurate application. The points of improvement to which attention is called are the following: (1). The points are no longer held in the hand but are firmly mounted. We are thus sure that the two will touch at once and with equal intensity; the contact is the same one time as the next, and

the time of contact can be regulated. (2). The distance between the points is easily set and accurately measured. (3). The points can be applied at any angle so that, *e. g.*, one can experiment upon the forehead or back with the subject in a normal sitting posture. (4). The points can be used singly by drawing out the rod *N*, and any number of points can be used. (5). The points can be applied to any part of the body by having a suitable support. (6). By using a double apparatus, two pairs of points can be applied to the same points on the skin, or simultaneously on symmetrical portions. (7). Points of any kind can be inserted—type, rods, or other patterns. (8). The points can be moved continuously along the skin, and thus used for mapping out "hot" and "cold points." (9). By making electrical connections the reaction time for touch can be measured.

HYPNOTISM AMONG THE ESKIMO.—Capt. Healy, in his last report of the cruise of the Corwin, reports a most singular performance resembling a spiritualistic *séance*. The wife of one of the natives, an old hag of 60, was observed to drop suddenly on the ground. Her lips were blue, her teeth were set hard together, while her labored breathing produced a light froth from her lips. The eyes were closed, the pupils much contracted, and the whole appearance of the eye expressionless. Her husband immediately ran to her, passed a stout deerskin thong around her head, and secured it to the end of a stout staff about 6 feet in length. He then sat down near the woman's head and brought the staff across his thighs, making a lever of the first kind. Then he began in a chanting tone to speak to a spirit of the dead concerning his probable success during the approaching hunting season. When a question was to be answered he paused and tried to lift the woman's head from the ground. If he succeeded it meant yes; if not, the contrary answer was inferred. The performance went on some time, and such force was used by the man that the poor creature's head was in danger.

During the *séance* the man had his rifle and hunting knife brought and placed near by to ascertain their qualities. When the questioning ceased the thong was removed from the woman's head, and with a few passes exactly similar to those used by mind readers, the woman was restored to consciousness. For a while she seemed dazed and unsteady, but soon commenced to narrate what she had seen in the trance. She claimed to have been far away in a deer country, to have seen relatives and friends of those present, who listened with rapt attention, and with the appearance of perfect confidence in her veracity, to the messages and news which she brought them. This happened at the mouth of Kowak river in Kotzebue Sound, Alaska, in August, 1885. O. T. MASON.